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I. Rathbone

FOOD MANUFACTURE

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Schemes for Increasing World Food Supplies

WHILE Boyd Orr warns the world that its soil lies in danger of serious and progressive erosion, there are not lacking a multiplicity of schemes for raising food production. How far they are practicable and how long they will take to mature time alone can show. They are bound to yield some interesting technical problems. For the moment it is an open secret that the African groundnut scheme is likely to be delayed by the most obdurate of all technical problems, that of man power. This is not the only difficulty; but it is so incalculable a one, that it is not safe to predict how much oil we shall have next year or in five years' time.

The prospects for the Queensland schemes are undoubtedly brighter. The potentialities of the area and of South Australia are said to be considerable and to have some resemblance to the Argentine pampas region. With the increasing uncertainty about Argentine meat shipments, these new areas of production may be a vital factor in our supplies. Meanwhile the plan to plant 225,000 acres in Queensland with sorghum for the rearing of pigs will afford a welcome relief to our bacon ration. The plan is conceived on a large scale and will involve the use of heavy tractors to haul five disc ploughs abreast.

The proposal to increase milk production in India is somewhat more ambitious. The low average yield of milk in India has meant an average consumption level that is only a little better than that of the Chinese. Indeed, the statement recently made by the Dairy Development Adviser to the Government, that the yield needs to be raised by 200 per cent., seems to underestimate the requirements. However, the Government of India is now considering a scheme to raise milk production by 10 per cent. at a cost of 500 million rupees in five years So brave a scheme deserves the best of fortune.

More immediately practical may be the fishery survey now being undertaken in South-East Asia. Associated with this, however, is perhaps the less simple problem of training native labour in modern fishing methods and in refrigeration. A trawler recently left Hull for Tanganyika, where she will be the first power craft to fish the East African waters. Other British master fishermen are now stationed in the Gold Coast and Sarawak, and the fishing prospects of the Indian Ocean are being studied.

There is little doubt that these expeditions will meet with several difficulties, some of which have been anticipated. For example, the high cost of refrigeration, almost a necessity in tropical waters, will be beyond the low purchasing power of the native population; but if this problem can be overcome the normal catches should be, if not large, at least steady. The plan for stocking the inland lakes and pools of the Colonies with selected fish may have better prospects of early yields. It has been successfully tried in Malaya, Russia, Palestine, and elsewhere, and it has distinct commercial possibilities. At all events, the world, even if threatened with erosion, is still able to "think big."

Fruits of Honduras

Though the political problems and threats, serving to remind us there is such a place as British Honduras, calmed down in the usual way, there still remain problems concerning improved agriculture in the colony. One or two reports published by H.M. Stationery Office within the last two decades pointed the way to improvements; but natives, as in African dependencies of Britain and other nations, are difficult to reform from inefficient yet ingrained methods. The timber trade rightly claims first interest in British Honduras, because of valuable exports in mahogany. Yet among other interests come grape-fruit, particularly from such rich alluvial loams as the Stann Creek Valley; bananas, first exported in history to temperate climes from Belize; rice of excellent quality; and, to round off a diverse agriculture, "loose skin" oranges, cohune nuts, and coconuts. All of which ignores one important product exercising the masticating faculties, namely chicle for chewing-gum, col-

lected at Cayo and Corosal and transported by water to Belize.

To consider grape-fruit further, since demands for this breakfast appetiser and source of salads and canned juice seem insatiable, the particular problems in British Honduras were reviewed by Professor H. Clark Powell. It seems that seedling trees must be abandoned in favour of budded grape-fruit trees; that Marsh and Duncan varieties are especially suitable to conditions. The fertile medium-textured loams, combined with a rail service from Stann Creek which is absent elsewhere, explain marked increases in grape-fruit exports from the combined region "British West Indies and Honduras." Studies of "gummosis" (instead of "gum" or chicle which is straightforward production) have shown that this fungus disease, attacking certain citrus fruits at the base of the trunk, is the chief enemy, causing collar root trouble or "collar rot" as it is called. Of nut crops, though the coconut is well established, the cohune nut with its 68 per cent. to 70 per cent. oil, coming from the cohune palm *Attalia Cohune*, provides similar features to West African copra and kernels on the one hand, and similar difficulties as regards technique in oil production to those experienced in African native groundnut oil extraction. Pounding the kernels, boiling with water, and skimming off the supernatant oil: such is the firmly-fixed motive of the Honduras native. With sugar-cane from the Toledo and Corosal areas, with suitable conditions for cacao cultivation, and with the above established agricultural products, this colony, opened up by buccaneers and now coveted by neighbouring interests, should add its quota to Britain's search for dollar-saving imports.

A New Crop

While *Cyamopsis tetragonoloba* as a crop native to India has been widely grown as cattle food, and occasionally for domestic consumption, this legume takes on a new lease in the American "guar," recently publicised in *Chemical Industries*. It seems that the old locust bean from Mediterranean countries, a source of gum thickeners, stabilisers, and sizing agents, must soon give way to this valuable crop yielding up to 1,500 lb. of seed per acre in California, Arizona, and other areas in the West, where 135 to 165 days' growing season is possible. The food industries are interested, since guar flour has proved useful for thickening ice cream mixes, salad dressings, and bakery mixes. Guar flour is dispersible in hot or cold water, yielding highly viscous solutions at low concentration and having from five to eight times the thickening power of ordinary starch. The legume produces clusters of bean-like pods with six to nine round seeds in each, these being very tough when dry and including galacto-mannan. Although guar is only now being appreciated as a crop with important industrial applications, the first notice of it on the part of the U.S. Department of Agriculture came as long ago as forty-five years.

Human Factors in Industry

During the conference on "Human Factors in Industry," held by the British Association's Division for Social and International Relations of Science last May, the findings of the Industrial Health Research Board's investigations in the fields of lighting, heating, and ventilation were summarised by Mr. Weston and Dr. Bedford. Recommendations given for "pleasant and invigorating working conditions" were: (1) Adequate air movement without local draughts; (2) air movement should be variable rather than uniform and monotonous, for the body is stimulated by ceaseless change in the environment; (3) relative humidity of the air should not be above 70 per cent., and should preferably be much below that figure; (4) the average temperature of the walls should preferably be higher than that of the air. The combination of cold walls and warm air often causes feelings of stuffiness; (5) the heads of the occupants should not be exposed to excessive radiant heat."

Dr. Tredgold, of the Roffey Park Rehabilitation Centre, declared that very little was known about human relations in industry. The need for social skill in those we call leaders was not sufficiently recognised, and, in selecting them, it has been assumed that technical qualifications are enough, but training for management is still inadequate.

In his clear summing up of the discussion as a whole, Mr. Alec Rodger, senior psychologist to the Admiralty, said that we should recognise the present importance of short-term research in the industrial field; that we should readily participate in the co-ordination of our researches (by groups of recognised and accepted experts who would "vet" research proposals and ask about each, "What problem is this meant to solve? How important is it that it *should* be solved? Is this the best way of solving it?"); that with the aid of the statistician we should make more determined use of ordinary observational and experimental methods of enquiry; that we should learn to communicate our findings, in simple words and pic-

tures, to everybody concerned (from politicians and senior civil servants to workers on the shop floor); and that, above all, we should investigate thoroughly the causes of managerial and shop-floor resistance to techniques intended to increase production.

Mr. Rodger suggested that the British Association should later stage a conference with a broader sweep, at which a series of short progress reports might be read on "fitting the man to the job" and "fitting the job to the man." Under the first heading might come work on the improvement of methods of vocational guidance, personnel selection, and occupational training. Under the second might come the improvement of methods of work, design and layout of working equipment, and working conditions, both physical and psychological.

Bread Enrichment Legislation

The enrichment of white bread and flour was first started in America in 1941 as a voluntary practice of bakers and millers. The percentage of output affected increased from 30 per cent. to 75 or 80 per cent., but the fraction not enriched included most of the low-priced flours, destined for low income groups which stood in greatest need of this nutritional benefit. In order to remedy this state of affairs, compulsory legislation was introduced, first in South Carolina, and then in other states, until by 1947 the total number of states which had taken this measure had risen to twenty-one. The programme was aided by a war food order requiring bread enrichment in January, 1943, but this terminated in October, 1946.

Although the practice has shown little decline since that date, the need of extending bread enrichment legislation is urged in an article which appeared in a recent issue of the *Journal of the American Medical Association*. In support of this argument it is stated that records prove the effectiveness of legislation in extending enrichment to cheaper flours, thereby helping to achieve an improvement in public health. Furthermore, it is contended that legislation, when supported by public opinion, provides insurance against neglect of the practice in times of greatest need. Compulsory enrichment of bread and flour would prove most valuable in the case of a business recession when the cost-cutting incentive would otherwise lead to serious curtailment.

Contrary to the contention of their opponents that enrichment encourages omission of non-fat milk solids from bread, supporters of the programme on the Food and Nutrition Board of the National Research Council advocate the use of milk in bread, and believe that war shortages of milk solids due to exports to Britain account for whatever reduction occurred in the inclusion of milk in bread. Non-fat milk solids as well as yeast, wheat germ, salt, fat, and sugar are permissible ingredients in both enriched and unenriched bread, and, apart from the so-called water breads, little loaf bread is made without milk solids. It is even claimed that the total milk solids used in enriched bread is probably five times that used in unenriched bread today, which fact dismisses the statement made that the product of the farms is being displaced by the product of the chemical factory.

The addition of pure vitamins to bread and flour rather than addition of milk, corn germ, yeast, or other natural carriers of vitamins does not affect the baking qualities of flour or the taste of bread as do the natural ingredients, and their compulsory addition would not render products unacceptable to the public on these grounds.

There is an increasing demand for "proof" that enrichment is benefiting public health, but it is argued that such proof can come only from long-term experience and observation of human nutrition. Animal experiments with bread as the principal or sole article of food depart from human practices so far as to invalidate tests. Therefore judgment must be based on the integrated experience of leading students of the intricate field of nutrition, and this continues strongly to support the enrichment programme.

There's as Good Fish in the Sea . . .

The prospects of a new food which might relieve present monotony are attractive, but if the public are expecting to have their palates tickled by sampling the contents of a small tin labelled snoek which has recently made its appearance in the shops, they may be disappointed.

The Ministry of Food did their best at a recent "party" to camouflage the deficiencies of this unattractive fish to be unloaded on to a public which can no longer be described as unsuspecting.

In these days of food shortages, fresh fish has been a standby in the home—*ad nauseam*—and it does not seem probable that the Ministry's attempt to popularise snoek will prove a great success in spite of the blaze of propaganda as to its "excellent nutritive qualities" and the usual flow of recipes for producing tasty dishes from it.

If we must import canned fish to eke out present rations, does it have to be a colourless and tasteless commodity?

Food Infection Campaign

It is computed that 5,000 deaths occur annually owing to food and drink infections, and that thousands of cases of minor ailments were also due to the consumption of contaminated food, and now is the time to wage war against the unhygienic handling of food. It could even be said that such a campaign was necessary to assist the present production drive. This was the argument put forward by the Chief Sanitary Inspector of Guildford when he outlined a scheme now operating in his district at a recent meeting of the Sanitary Inspectors Association.

The unsatisfactory conditions revealed as a result of a survey of food premises in Guildford, carried out in 1946, were found to be due mainly to structural dilapidations, inadequate washing and cleansing facilities and insufficient sanitary accommodation, while the standard of personal cleanliness of some employees left much to be desired. Recognising the fact that public support would be more useful than any form of legislation, it was decided that some action should be taken to stimulate the interest of traders and public alike in the subject of hygienic handling of food since no amount of facilities could be effective without the co-operation of food workers.

At a conference called by the Sanitary Inspectors, to which representatives of the Chamber of Commerce and the Food Traders Associations were invited, the formation was recommended of an organisation to be known as the Guildford Hygienic Food Traders Guild. Membership would be open to employees as well as traders, and all members would have to comply with the codes of practice to be drawn up for the respective food trades.

An advisory committee was appointed to work out details and administer the scheme. To stimulate public interest, an exhibition was held which featured such subjects as hygiene in food shops, meat and food inspection, the work of sanitary inspectors, ice cream manufacture, and so on. This exhibition proved successful, and great interest was shown in the exhibits.

The next step was the consideration in detail of the proposed codes of practice by a special subcommittee, again including members of each trade concerned. Widespread publicity was given to the scheme, which was officially opened on March 1, 1948, while informal talks to food trade employees were arranged, and the subject was even introduced into schools. In order to maintain the interest which these efforts have aroused, the Guild propose to issue periodical informative bulletins for traders, to arrange visits to model factories and occasional social activities in addition to the continuance of talks.

Many obstacles have had to be surmounted in the launching of this campaign. There have been difficulties over the open display of food, a practice frowned upon by the Guild, while problems such as insufficient supplies of crockery, laundry troubles, unsatisfactory handling of meat before reaching the shops, and the obtainment of building licences have had to be tackled. The Guild have, however, succeeded in ameliorating the position in many cases and the response they have so far received has encouraged them to continue their work. They have, in addition, created a better understanding with traders, which will form the basis of a good working arrangement in the future.

Fishermen of England

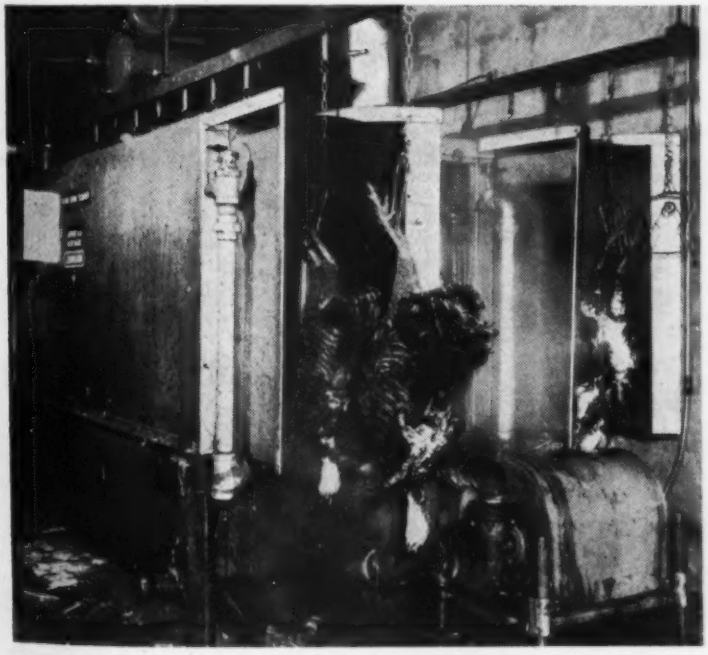
Since both deep-sea and offshore fishermen have had their praises sung, is there no line for those patient, contemplative men in old sports jackets and drab grey bags past their prime, men who seek to add to the larder in these hard times? Studding green banks of rivers in Fenland and elsewhere, hour after hour waiting for a bite, one sees them as even more a part of the English scene than those fishermen by the Seine represent Paris, men who get all the publicity without apparently catching anything else. And there are the fishermen from the quayside or pier beside the sea: the very antithesis of the rest of holiday makers. Let the bands play or loudspeakers bray, let the youngsters shout and splash, let the elders unbend to chase the bouncing ball or perpetually parade in search of a hypothetical ozone ration, it makes no odds to these quiet optimists who stay long after the raucous masses have wandered off to hotel or boarding-house for the next meal.

A rod, a line, and a heterogeneous supply of bait are sufficient to sustain the spirit; a packet of sandwiches will do for bodily sustenance. From such springs felicity, rain or fine, and hope for one little tug on the line, a sign maybe of no more than a sand-dab. Those research men of marine biological stations who wonder at queer noises (detected by submerged microphone) which fish make, who ask why horse mackerel and other species are ever literally gnashing their teeth, have never considered the fish's point of view—to be tempted and taunted hour after hour by luscious morsels, by tit-bits with ever the barbarous hook concealed therein by these harmless, drowsy fishermen whose tranquillity defies all political and international strife.

Turkeys are taken out of their coops and hung by their feet on shackles travelling on an overhead conveyor line. As the birds enter the plant, the killer opens their mouths and penetrates the bird's brain with an electric killing knife, simultaneously opening the jugular vein to permit free bleeding. A 110-volt electrode attached to the knife presses against the back of the turkey's head causing electrocution, thus lessening the violence of the dying bird's struggles, preventing bruises, and relaxing the feathers so that hot water from the scalder can more easily penetrate them.

Poultry for Table by Machinery

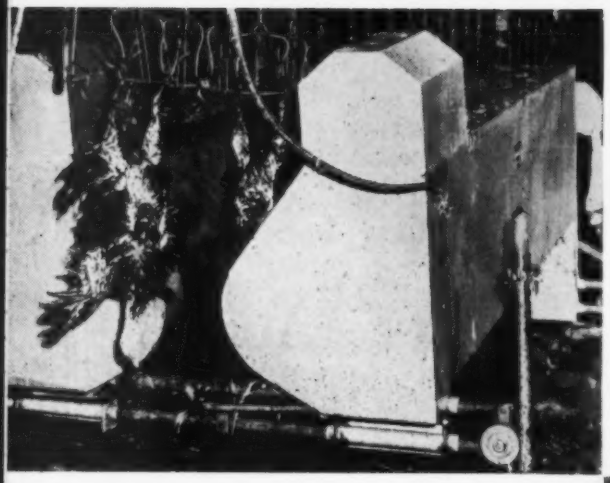
Now in the midst of its first production season, the $500,000 poultry killing and processing plant of the Washington Co-operative Farmers' Association at Mount Vernon, Washington, U.S.A., is believed to be one of the largest and most modern in the world. It has a rated capacity of 16,000 chickens and 7,000 turkeys daily on two interchangeable lines, the Albright and the Johnson.



After the turkeys have been killed they enter the hydro-spray scalder and emerge on the right after passing through a series of hot water sprays. These penetrate the feathers to the skin and provide a uniform scald, making picking easier and enabling the birds to bleed out better.

THE killing and processing plant serves 11,450 members of the Association within a radius of sixty-five miles. Live chickens are brought to the reinforced plant in trucks, either by the farmer or by the Association. The 250 trucks follow regular routes, reaching each section once in every two weeks, making collections as requested. The coops, furnished by the Association, are wheeled into the storage room and the birds are transferred into batteries. When the chickens are to be killed, the battery is wheeled outside to the conveyor line. Both the empty batteries and coops are steam-cleaned and disinfected.

Turkeys are taken in their coops by a hoist directly from the truck, and removed immediately to the conveyor line for killing. The conveyor is a chain of ball-bearing wheels placed in vertical, then horizontal, positions and running within an enclosed rectangular tube. The shackle is attached to a clevis which hangs through a slot at the bottom of the tube.



Above: An automatic guide in the mechanical rougher turns the birds as they move along the line. As the entrance is lower than the exit, the birds move gradually deeper into the revolving picking fingers, allowing picking to begin on the upper part of the body and end at the legs. The flexible rubber picking fingers are about 14 in. long and half an inch in diameter, and are serrated so that they may catch and hold to the feathers, pulling them from the bird's body.

Right: The first worker is operating two wing strippers, each of which is comprised of two directly opposed revolving steel cylinders set closely together. The next operator is working at the double side-line rougher, consisting of two counter-rotating dual drum units.

As the turkeys emerge from the double side-line rougher they are reversed so that the feathers may be picked from the birds' legs by the machine on the left.

The wheels are placed both vertically and horizontally, so they will operate freely while carrying weight on both tangents and curves in the conveyor line. Each killing line is about 380 feet long, the trip for the birds taking from twenty to thirty minutes.

After the turkeys are killed, a man removes the tail and wing quills by hand. The bird then enters the scalder—a hydro-spray scalder on the Johnson line, an immersion scalder on the Albright. From the sprayer they go into a mechanical rougher, and, on the Albright line, through a hand-operated rougher and a wing-stripper before pinning.

On the Johnson line, two wing-strippers are placed next to the automatic rougher, with the birds next going through a double side-line rougher and a single side-line rougher before entering the pinning department.

After pinning, birds on the Albright line are hand-singed and hung on cooling racks. On the Johnson line, the birds go through an electric-gas singer, with thirty-six jets, which automatically singes the bird completely and uniformly without burning. An electric eye located near the conveyor is actuated when the circuit is broken by the passage of a hook-and-shackle. The eye opens a gas valve and the gas is ignited by a pilot flame. When the shackle has passed the electric eye, the valve closes. Johnson-line birds then move into an automatic spray-washer, which sprays birds with cold water under 40 lb. pressure, while two revolving cylinders of rubber fingers remove loose feathers and blood on the exterior of the bird and the blood clot from the mouth. These birds then are taken from the conveyor line and placed on to cooling racks, which are moved into one of four pre-cooling rooms.

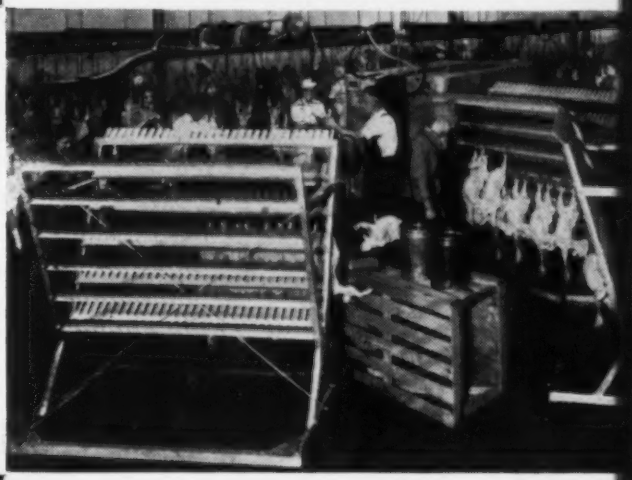
Birds are kept in these rooms from six to twenty-four hours at a temperature of 30° F. to 32° F., their internal temperature being reduced to at least 36° F.

From the pre-cooling rooms, the birds are taken either to the packing crew in one of the pre-coolers, where they are packed New York dressed style, or to the eviscerating room. When New York dressed, the birds are packed in wooden boxes lined with freezer-proof paper. Chickens are packed six or twelve to the box; turkeys, four to eight.

The eviscerating room has two identical conveyor lines, one for turkeys, the other for chickens. Birds are placed on a table where a woman cuts off their legs at the knees and also cuts out the oil sac. A man then hangs the bird on the shackles, head down. First operation is the removal of whatever pin feathers remain, after which a woman slits the neck skin and a man works the skin down to the body. Another woman loosens the crops and three remove them over the slitting trough. The next worker cuts the wind-pipe and gullet, after which

Above: After leaving the last of the picking machines, the turkeys are again reversed and enter the pinning department where 60 to 75 women select and follow a bird along the conveyor, removing the pin feathers with a pinning knife. These operators can pin as many as 70 turkeys or 500 chickens in an eight-hour day.

Right: After going through a singer and automatic spray washer, the turkeys are graded and transferred from the overhead conveyor to cooling racks which hold 180 chickens or 24 to 40 turkeys each.



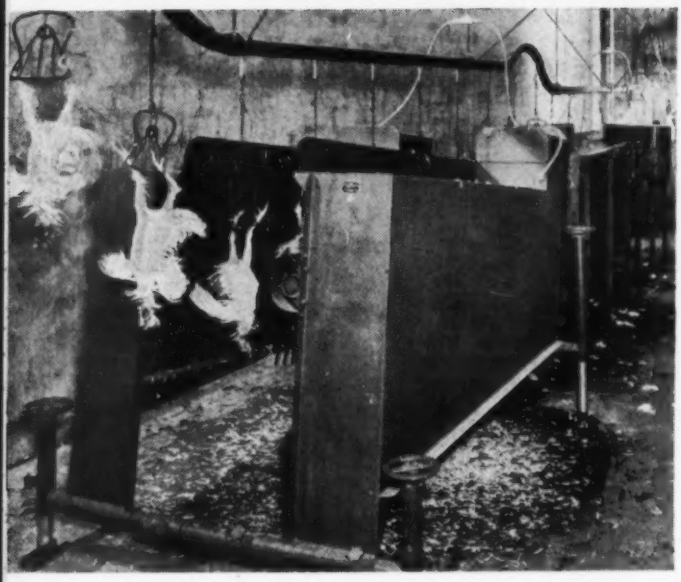
In the eviscerating room, the woman on the left cuts the neck in two places, leaving the severed neck remains on the shackle, the three women on the right removing the lungs and kidneys.

a man pulls the bird's neck up on the shackle so the bird is suspended at three points—neck and two legs. The next two workers make a horizontal cut above the vent and also around the vent, making possible the easier removal of entrails by the next two women.

The line at this point passes over an oval inspection table, where trays travel beneath each bird. The entrails are dropped in one of these trays and examined for internal disease. The next worker snips out the heart and liver, washes them in water running around the trough in front of her, and puts them in a colander on an adjacent table. The last worker at the table snips out the gizzards and drops them down a chute to the gizzard station, where four women clean them.

The trays continue around the table and dump the offal, after which they enter an enclosed steam sterilising unit.

After evisceration is completed, the bird goes by a worker equipped with a manual washer whose 80 lb. pressure spray washes away extraneous



Chickens emerging from the automatic rougher on the Albright line with the immersion scalder in the background.

material remaining in the bird's cavity. It is then conveyed through an automatic outside-washer, which washes the outside of the bird. An air blast dries it as it moves along the conveyor to an inspector.

From this point, the operation varies with the type of birds being processed. The birds are divided into four classifications: 1. Full drawn fowl, roasters, or turkeys. 2. Pot-prepared birds, cut-up fowls for stewing. 3. Pan-prepared, cut-up young frying chickens. 4. Split broilers.

As the eviscerated turkey nears the packaging table, one woman takes the neck from the shackle and drops it into the bird's cavity, with a heart, gizzard, and liver. A man then takes the turkey off the line and tucks the legs into the cavity, where they are held by a strip of skin remaining below the vent. He hands the turkey across the table to a woman who places it in the turkey bagger, a semicircular metal basket held to the side of the table by a hoop over the middle. Turkeys, unless intended for institutional use, are wrapped in a transparent plastic bag which is stretched over one end of the bagger. The turkey then is pushed down the basket into the bag and the bagged turkey placed back on the conveyor table. The next worker places a suction hose in the bag to remove surplus air, and the next twists the bag to prevent air from entering, tying it with a wire from which hangs a tag giving instructions for defrosting. At the end of the table the birds are weighed, weight marked on the tag, packed six to eight to a box, and put on flats, after which they are moved to the freezing department in the basement.

When eviscerated turkeys are packed for institutional use, they are weighed four together and the turkeys placed unwrapped in the boxes, covered with a wet spruce mat to guard against freezer burn.

Full-drawn chickens are weighed six together and placed unwrapped in a cardboard carton, which then is sealed.

Pot-prepared and pan-prepared birds are split with a bandsaw, after which wings and legs are removed. All parts then are placed on a conveyor and assembled in an individual Cellophane-lined carton, after the heart, liver, and gizzard have been wrapped in parchment at a separate table. The cartons are placed in a master container, six to the case.

After freezing, the poultry is stored in a low temperature holding room, which has a capacity of 340 tons of poultry. This space is refrigerated to an average temperature of 0° F. Two loading ports open on to the railroad car-loading platform. Refrigerator trucks as well as railroad cars are used to transport the frozen product to market.

This automatic immersion scalder on the Albright line has water heated by live steam which enters through perforated pipes at the bottom of the scalder, the water being agitated by two high-speed agitator pumps with propellers located at the bottom of the scalder.

Acetic Acid Preserves

Part IV

J. R. BURRELL

Salad dressings, mayonnaise, and sandwich spreads are important acetic acid preserves. Their composition has materially changed during the past few years. Modern recipes are given in this instalment.

IN the past salad dressings, mayonnaise, and sandwich spreads were essentially emulsions of oil and vinegar flavoured with spices and thickened and stabilised with yolks of egg, gum, and flour.

Nowadays there is an ever-increasing tendency to make use of thickeners and emulsifiers of the alginate, methyl-cellulose, poly-galacto-xylose or glyceryl monostearate types, all of which are suitable for the purpose, though differing in the kind of emulsions produced and in the methods needed for incorporating them.

Soya flour, too, is often used as a stabilising material; if this material is made into a suspension which is boiled and then acidified, the product acquires a thick, creamy consistency, not characteristic of its former state. When it is mixed and then emulsified with oil a fairly stable emulsion is produced.

There is a great deal of variation in individual recipes, and the salad cream marketed by one manufacturer may be similar in flavour and consistency to the mayonnaise prepared by another, so that it appears that the original difference between mayonnaise (with its high oil content and "body") and salad cream has become less marked. The commercial articles are usually extremely similar in composition and mode of manufacture, so that both will here be treated together. The consistency of both, in any case, is largely decided by the desire of the customer to get the products out of the bottles in adequate, but not too copious, quantities.

Basic Recipes

There is usually at least 30 per cent. oil present, up to 2½ per cent. salt, and 5 per cent. sugar, egg yolk (up to 20 per cent.), thickener, and vinegar. For flavouring, mustard, chervil, or chive essence, tarragon, and paprika are used.

The oil may be from maize, soya bean, sesame, cotton-seed, and arachis. Good, clean-tasting edible grades of low free-fatty-acid content must be used, and not the harsh-flavoured inferior grades of those marketed for non-edible purposes.

Olive oil is not now in general use for mayonnaise and salad cream, as the flavour tends to deteriorate rather rapidly, and most grades are too strongly flavoured, although those of the Lucca and Provence types are bland but expensive.

Egg yolks may be those from fresh eggs, cracked and separated by hand in the factory, or in the form of the liquid frozen pack. The latter are subject to extremely rapid deterioration after thawing, on account of high initial microbial contamination, so that only the amount required for the day's work should be drawn from the refrigerator at a time.

Preparation Outlined

The egg yolks, salt, sugar, mustard, and thickener are whisked with the vinegar and heated, with stirring, in a stainless steel jacketed boiling pan.

The mixture is kept at 180° F. for fifteen minutes for the purpose of destroying the initial bacterial flora, and is then allowed to cool to 120° F. It is then transferred to a cylindrical vessel containing a mechanical stirrer and the oil added in a thin stream with the stirrer going at a fairly high speed. The coarse emulsion thus prepared is then put through an emulsifying unit in order to produce a fine emulsion which will remain stable indefinitely.

The plant required consists of a stainless steel jacketed pan of suitable capacity, a mixer, an emulsifying machine, and a filling machine.

The Emulsifying Process

The mixer and emulsifying unit may both form part of one machine, in which the mixer, usually of the cylindrical type, is placed on a higher level than the emulsifying unit so that after the mixing (coarse homogenisation) is completed the mixed oil and water phases may enter the hopper of the emulsifying unit by gravity.

There are several well-known emulsifying machines, and also other machines which, although termed emulsifiers, are really only mixers and not suitable for the production of fine emulsions of the type required.

In the usual type of emulsifying machine the mixture is pumped by strong piston action through microscopic gaps between two metallic surfaces, the distance between which are adjustable. In one machine the mix is forced between a semi-spherical socket and a metal ball which is spring-loaded into it. Great pressure is required to achieve the maximum emulsification. A similar result is attained in

another well-known homogeniser by the rotation of a cone-shaped piece of metal at high speed within a similar shaped outer cone into which it fits. Here, again, the distance between the outer surface of the inner cone and the inner face of the outer is very small and can be varied.

There are theoretical objections to emulsifying units which dip into a tub of the mixed oil and water phases sucking up the mixture, rotating it, and breaking it up in various ways and then returning it to the mix.

In this case the completed emulsion, fine or coarse, goes back into a container which is lined with un-emulsified mixture. The presence of "free" oil or large globules of oil may later lead to a tendency, constantly increasing with the passage of time, for the microscopic, adequately small globules of the true emulsion to coalesce, causing its eventual breakdown.

The appearance of the finished product indicates the fineness or otherwise of the emulsion obtained; for the breaking up of oil into infinitesimal globules is a phenomenon similar to that which occurs when a clear crystal is smashed to powder. The material in both cases becomes intensely white by the scattering of light. The more coarse the emulsion the more yellow it appears, and conversely the finer it is the whiter it appears. This can be confirmed by a microscopical examination to ascertain the actual mean size and uniformity of size of the globules, but a sample bottle of known fineness of globule size can be a good guide for comparison purposes.

Need for Standardisation

When preparing creams for the first time it is wise to establish a standard for mean globule size as soon as possible, and subsequent manufacture should, where the recipe is unchanged, not vary greatly from this. It is necessary that the emulsifying equipment should not beat air into the mixture, as this may lead to separation of oil and water constituents. Breakdown will also occur if the globule is above a certain size. This varies according to the product, and the stabilising ingredients incidentally present or purposely added, certain constituents of the yolks being examples of the first and alginates, methyl-cellulose, or gum among the second.

Clean, dry jars must be used, and any that have become contaminated internally with small quantities of the cream must be cleaned and dried before use, otherwise the thin layer might have lost its water by drying and the oil remaining will act as focal points for coalescing the oil globules and so gradually bring about a breakdown of the emulsion. The theory of emulsions is not simple, and the complicated physical phenomena involved are best left to colloid experts to explain. Dr. W. Clayton's works in particular contain a wealth of information on the subject.

Keeping Properties

Pasteurisation would lead to breakdown of the emulsion; salad creams must be prepared with an acidity high enough to inhibit yeasts, moulds, and lactobacilli of the lycopersici and pento-aceticus heterofermentative types. A high total acidity, however, makes for an unpalatable product, but since it happens that the same fundamental rule that acidity must be reckoned to be in the moisture content of the product and not on its total weight, it follows that a salad cream of high solids and oil content needs a comparatively low acidity to make it reasonably safe as regards proneness to fermentation. To take a simple hypothetical case, a salad cream with 50 per cent. combined solids and oil content, and a total acidity of 1·8 per cent., would have double that acidity if this were computed to be present in the water alone. A cream built up on this basis, therefore, would be in accord with the keeping requirements of the minimum of 3·6 per cent. acidity on the moisture content rule.

Sandwich Spreads

A mixture of drained, comminuted vegetables, covered and mixed with just that amount of salad dressing that will lubricate and hold it in suspension, comprises sandwich spreads. In order to prevent separation, the vegetables must be thoroughly drained, and it is necessary constantly to turn them about during the draining to enable some drying to take place. They must be adequately pickled and acidified, and the acidity rule must apply to both the solid and cream fractions. Spreads are subject to the same possibilities of spoilage as are pickles and salad cream, except that there is an increased tendency for the oil and other constituents to separate.

Types of Closures

Closures are almost invariably of the screw type of either internally lacquered metal or bakelite. If unlacquered metal is used it is advisable for waxed board and Ceresin discs to come between the cream and the metal cap. Aluminium caps are attractive but susceptible to spot corrosion when in contact with acid, which renders them liable to pin-holing. If this occurs in a cap it leads to rancidity and darkening of the surface of the cream as well as leakage.

The original spreads were simply a suspension of chopped, brined vegetables in a mayonnaise base. Nowadays, however, some brands are marketed which have no oil ingredient whatever. These are inferior to the original, but apparently have some appeal on account of cheapness and the fact that non-controlled products are used.

With regard to the first, the chopped vegetables (which may include fruits such as the tomato) are acidified in vinegar, drained, and mixed with an approximately equal quantity of mayonnaise.

Equal proportions of onions, carrots, cucumbers, and cauliflower stump are chopped and mixed in the bowl chopper after having been kept in vinegar for four days.

The chopped, mixed vegetables are thoroughly drained and then incorporated in bulk in the mayonnaise by means of a spaddle mixer.

Non-emulsion Type of Spread

Soya flour	42 lb.
Water	17 gal.
Vinegar (5·0 per cent.)	8½ gal.
Gum tragacanth (2½ per cent. in vinegar)	8½ gal.
Saccharin	*q.s.*
Mustard	3½ lb.
Meat extract	3½ lb.
Ground cinnamon	13 oz.
Ground pimentos	1½ lb.
Ground mace	1½ lb.
Garlic	½ lb.

All of the ingredients are whisked together and brought to the boil in a jacketed pan. The chopped vegetables, as prepared for the later recipes, are then added in ratio of 10 pints to 16 pints of the above mixture, the whole is well mixed, and is ready for filling.

If a spread is required that may be filled cold and will need no pasteurisation process, it will be necessary to add 7½ lb. acetic acid toward the end of the cooking process as well as a proportion of sugar to mellow the sharpness somewhat (5 per cent. to 10 per cent.). The acidity of the finished product should in this case be about 3·2 per cent.

Non-Standard Dressings

When preparing a non-standard product (containing less than 25 per cent. oil and less than 1·35 per cent. of egg yolk solids), it is necessary that the labels should bear a statement that it is not a standard article, as well as a list of ingredients. The standard product, however, may be labelled "Mayonnaise" or "Salad Cream," and is exempt from a declaration of ingredients.

At the present time there being a shortage of eggs and edible oils, it is often necessary to market products which contain little or no egg and a smaller proportion of oil than the standard. These products are not salad cream or mayonnaise within the meaning of the regulations, and must not be described as such.

Sample Recipe of Salad Cream

	Per Cent.
Egg yolks	5·0
Edible vegetable oil	40·0
Mustard	2·5
Salt	2·0
Sugar	2·0
Wheat flour	2·0
5 per cent. distilled vinegar (or 10 per cent. spirit vinegar broken down with an equal quantity of water)	33·0
Water	12·5
Gum tragacanth or other thickener	1·0

The gum is added in the form of a solution in vinegar, some of the latter being subtracted for that purpose.

When using other thickeners it is wise to prepare these as advocated by their various manufacturers, for although they may give a mucilage of a certain viscosity with water, addition of acid may result in great modifications as with some of the patented vegetable gelatins which thicken in the presence of acetic acid.

Methyl-cellulose and poly-galactose-xylose are not affected in this way, and 1 per cent. of these in water is often sufficient to produce the effect required.

Non-Standard Salad Dressing

	Per Cent.
Water	11·0
Distilled vinegar (5 per cent.)	46·0
Edible vegetable oil	30·0
Mustard	3·0
Salt	2·0
Sugar	2·0
Gum tragacanth	1·0
Flour	2·5

Colouring

If there is sufficient incorporation of egg yolks and mustard the colour should not need modifying, but occasionally samples of frozen yolks may lack the depth of tint necessary to give the desired result, and in this case oil which has been coloured by heating with turmeric and then filtered may be used as part of the oil constituent.

Use of Lactic Milk Cultures

Lactic acid has sometimes been used as an acidifying agent in the manufacture of salad cream, partly in order to modify the sharpness given to the product by the acetic acid added in the form of vinegar, and partly because of its real or fancied bacteriolytic action that has been thought to be not wholly dependent upon *p*H but also upon some definitely toxic action that this acid is thought to share with formic, succinic, and propionic acids.

With regard to the first point, it is obvious that the sour, cheesy taste of lactic acid affects the flavour of any product in which it is used, and it is generally agreed that the modification in flavour is in the direction of a good article, so that the addition of this acid may be regarded as desirable.

There has been some experimentation in this connexion, and as only a proportion of the acidity of a finished product can be due to lactic acid, for the predominating taste of salad cream or mayonnaise must be acetic, it is thought that the lactic acid might be added in the form of a lactic milk culture.

Experience has shown that salad cream, mayonnaise, or any other condiment creams are improved when this is done. This is not surprising, for there is a big difference between the taste of milk coagu-

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Ministry of Food

Latest Statutory Rules and Orders

The list given below is the continuation of the list of Orders published in *Food Manufacture*, June 1, 1948, page 278.

No.	*Date.* 1948.	PRICE FIXATION ORDERS
1018	May 23.	Order amending the Table Jellies (Maximum Prices) Order, 1946.
1042	„ 23.	Order amending the Imported Canned Fish (Maximum Prices) Order, 1947.
1044	„ 18.	The Milk (Control and Maximum Prices) (Great Britain) Order, 1947 (General Licence) Order, 1948. Revokes S.I. 1948, No. 827.
1054	„ 23.	Order amending the Cereal Breakfast Foods (Control and Maximum Prices) Order, 1947.
		CITRIC ACID AND TARTARIC ACID
808	Apr. 21.	The Citric Acid and Tartaric Acid (Revocation) Order, 1948. Revokes S.R. & O. 1942, No. 2148; 1944, No. 1279; 1945, No. 1308.
		FOOD SEIZURE
953	May 6.	Order amending the Seizure of Food Order, 1948.
		FRUIT
828	Apr. 27.	The Tomatoes Order, 1948.
		ICE CREAM
819	Apr. 30.	The Ice Cream (Heat Treatment, etc.) Regulations, 1947 and 1948.
		IMPORTED FOOD
886	May 1.	Order amending the Public Health (Imported Food) Regulations, 1937.
		LINSEED
824	May 18.	The Home-Grown Linseed (Control) Order, 1948.
		MEALS IN ESTABLISHMENTS
996	May 12.	Order amending the Meals in Establishments Order, 1946.
		MILK
827	Apr. 25.	The Milk (Non-priority Allowance) (No. 2) Order, 1948. Revokes S.I. 1948, No. 483.
829	„ 25.	The Milk Marketing Board (Modification of Functions) Order, 1948.
		POINTS RATIONING
825	Apr. 25.	Order amending the Rationing (Personal Points) Order, 1947.
826	„ 25.	The Rationing (Personal Points) Order, 1947 (Directions No. 2) Order, 1948.
		POTATOES
947	May 5.	The Potatoes (Control of Supply) (No. 2) Order, 1947 (Revocation) Order, 1948. Revokes S.R. & O. 1947, No. 2676.
		RATIONING
1019	May 23.	The Food Rationing (General Provisions) Order, 1947 (General Licence No. 4) Order, 1948.
1040	„ 23.	Order amending the Fats, Cheese, and Tea (Rationing) Order, 1947. Revokes S.I. 1948, No. 411.
		VEGETABLES
911	May 2.	The Onions Order, 1948. Revokes S.R. & O. 1946, Nos. 1743, 2126; 1947, Nos. 1423, 1890, 1928, 2375; S.I. 1948, No. 539.

Acetic Acid Preserves

(*Continued from page* 311)

lated by the addition of say ½ per cent. of lactic acid and a glass of a culture of *Lactobacillus bulgaricus*. The latter has a deliciously mellow, creamy flavour and a bouquet that is entirely lacking in the other. This is no doubt owing to the small quantities of innumerable other by-products of the lactic fermentation.

The proportion of soured milk must vary according to the modifying effect it has on the flavour, but in keeping to an original recipe it must take the place of one of the watery constituents. Naturally, if vinegar is displaced by the addition of the culture the acidity can be easily adjusted by the addition of small quantities of strong edible quality acetic acid.

A *Lactobacillus bulgaricus* starter may be used, as this organism gives a high acidity and imparts a smooth uniform consistency to the milk.

Before the addition of the starter culture the milk must, of course, be pasteurised in order that harmful organisms should not undergo incubation and give rise to spoilage. The growth of the *Lactobacillus bulgaricus* is fairly rapid, and provided reasonable precautions are taken, an almost pure culture can be obtained. After pasteurising, the milk must be cooled and then fed into the incubation tanks, where a thermostatic arrangement keeps the temperature constant. The bulk culture is ready for use at the end of twenty-four hours, for at the end of that time the acidity should be at its maximum. The titratable acidity can be ascertained and, if necessary, the culture left for a further few hours until the acidifying process is completed. The soured milk is then ready for use in the cream.

(*To be continued*)

The Food Group Visits Eire

The Food Group assembled with the Lord Mayor of Dublin on the steps of the Mansion House.

The 1948 summer tour of the Food Group of the Society of Chemical Industry, besides being a great success, proved to be one of the most fruitful in the furtherance of professional and social relations between those concerned with the food industry of the two countries.

THE tour began at Euston Station on the Fourth of June not many minutes before the train started. Everything had been arranged—tickets, seats, tea, dinner. Our departure had the blessing of Dr. Lampitt, who came to see us off, and whose smiling farewell was a good augury.

It was certainly going to be a good tour. The air was charged with pleasant expectation. Dublin was reached without incident, and members were whipped away promptly to one of seven hotels, and in the evening we met at an informal gathering at the Shelbourne Hotel, where old acquaintances were renewed and new ones made.

On Sunday afternoon we set out, in pouring rain, which slightly affected the view but not our spirits, on a coach tour of the Wicklow mountains, our first sight of the beauty which is Ireland. Emerging from leafy lanes of almost incredible greenness, the vista of Killiney Bay reduced our coachload to silence.

At the end of the graceful sweep of its shore was Bray Head promontory, leading landwards to the Little and Big Sugarloaf Mountains, blue and mysterious through the mist. A long detour took us through Bray, the Vale of Avoca, and the Seven Churches. Then Dublinwards by a different route, through Greystones, where we sampled our first Group tea. The sudden influx of nearly 100 hungry pilgrims might dismay any country hotelier, but not "Mine Host" of the Grand Hotel. We were deftly and quickly served by the soft-voiced, pretty Irish waitresses, and it was not long before the most voracious of us were forced to call a halt.

Bright and early next day we visited Dublin Dairies, Limited. On our arrival we were ushered into the canteen, where Mr. and Miss McInerney and Mr. Lennon and Mr. Stritch dispensed lavish hospitality forthwith. Dublin Dairies were the first of our many hosts, and we had the first taste of an Irish welcome. Here we experienced the sense of gaiety and vivacity—of *joie de vivre*—which permeated the atmosphere. Dublin Dairies are justly proud of their concern, which had started only last November. The holder pasteurising plant and bottling plant were in full swing, handling the 8,000 gal. of milk which is the initial daily output.

Preparations for an important ice cream department were almost complete. In another department was seen the preparation of some of the 20,000 sandwiches daily prepared for school children, deftly spread with real butter and filled with slices of cheese by a small army of girl operatives. With much waving of hands we departed, and those whose first experience of the Irish people it was (and there were quite a few) were deeply impressed with the spontaneity and warmth of their reception.

A Look at Dublin's Food Factories

From the dairy we proceeded to the factory of Irel Co., Ltd., producers of coffee essence and ground vacuum-packed coffee in tins. (Let it be recorded that even if, in this chronicle, sufficient mention be not made in every case of the welcome accorded to the groupers, it is by reason of the avoidance of vain repetition—for in every case it was generous and free.)

The sequence of operations from the raw bean to the final labelled bottle of coffee essence was seen and explained and questions answered, and similarly with the preparation of vacuum-packed coffee. The operations of R. and A. Anderson, who pack a wide range of food and pharmaceutical preparations, on the same premises as the Irel Co., were next inspected. It was impossible not to admire the excellent lay-out of the departments and the evident efficiency of those concerned with them. This visit culminated in a pleasant meeting in the offices of the companies, where the ladies of the staff entertained us not only with tea and cakes, but with animated conversation and charming manners. Reluctantly we tore ourselves away for lunch.

In the afternoon the Group, in three sections, visited Williams and Woods, whose important factory is concerned with the preparation of a large assortment of food products, including vinegar, pickles, sauces, canned goods, jams, sweets, and chocolate. We were received by Mr. R. Thompson, the managing director, and after an extended tour of the factory and laboratories, we foregathered in his office, where luscious confections made in the factory were sampled.

Dublin's Lord Mayor Receives Us

Tuesday was a full day. In the morning we attended a reception by the Rt. Hon. Lord Mayor of Dublin, Councillor P. J. Cahill, P.C., at the Mansion House. In his speech the Lord Mayor welcomed visits between peoples of different countries, which strengthened goodwill and friendship. On meeting each other they realised, perhaps with some surprise, that they were human! Our chairman, Dr. E. B. Hughes, expressed, on behalf of the Group, the gratification at their meeting with Dublin's leading citizen.

Our next call was at Guinness' Brewery, the main party inspecting the brewery and a smaller party the laboratory. As on previous days the visit was made especially interesting by representatives of the company, who gave clear and painstaking explanations of the different stages of the manufacture of their celebrated brew. The laboratory party was impressed by the very complete system of control exercised by the large staff of chemists under Mr. Tullo. By courtesy of the directors, the main party lunched at the brewery, while the laboratory party was conveyed to the Royal Hibernian Hotel in a bus provided by the company.

The afternoon was occupied by a visit to the Albert Agricultural College and model farm. The College celebrated its centenary this year, and has been, since 1926, the headquarters of the Faculty of General Agriculture of University College, Dublin. We were very interested in the account of the research work carried out in agriculture, horticulture, and forestry, and thanks are due to Professor Drew and his staff for their clear exposition on the work of the College.

Alcohol . . .

On Wednesday we left for Greenore *via* Drogheda, where, after a ride through lovely country, we had an excellent lunch at the G.N.R. Hotel. *En route* we had our first glimpse of the Mountains of Mourne, which immediately incited some of the musical (?) members to vocal efforts. On the return journey the alcohol factory of Ceimici Teoranta at Cooley was visited. This factory is one of five operated by this government-sponsored company in which alcohol of industrial and potable grades is produced. The distillery, although originally intended for the disposal of surplus potatoes, is also equipped to work Irish beet molasses or imported cane molasses. We were received by Dr. Van der Lee and his colleagues and taken round the different departments. Cooley was left by coach late in the afternoon, and the return to Dublin was made through the beautiful scenery of the Boyne valley.

. . . and Water

Early on Thursday we left Dublin on a visit to the hydro-electric station and water purification plant at Poulaphouca. This joint scheme is based on a reservoir created by a dam built across the narrow gorge of the Liffey, impounding 36,000 gal. of water. The power station runs at full load at peak hours daily and generates 30,000 kW. The water then passes into a subsidiary reservoir, whence its flow generates a further 5,000 kW. throughout the twenty-four hours. Water drawn from the main reservoir for water supply (8 to 9 million gal. per day) is purified and piped twenty-five miles to Dublin.

Leaving Poulaphouca by coach, we lunched on turkey and Limerick ham at Lawlor's Hotel, Nass, and in the afternoon visited the Science Buildings, University College in Dublin, where at a joint meeting with the Irish Chemical Association and Dublin Section, Royal Institute of Chemistry, under the chairmanship of Dr. A. G. G. Leonard and Professor T. S. Wheeler, two papers were read —one on "Whiskey," by Mr. V. H. M. Bowers, B.Sc., A.R.S.C., Assistant Distiller, John Jameson and Son, Ltd., and one on "Some Present-day Problems in the Beet Sugar Industry," by Mr. J. L. Ginnell, B.Sc., Technical Adviser, Irish Sugar Co., Ltd.

We are the Guests of the Irish Food Manufacturers' Federation

In the evening the Group were guests at a dinner given by the Irish Food Manufacturers' Federation, Mr. R. Thompson, President of the Federation, presiding, and at which were present the Prime Minister, Mr. John A. Costello, T.D., Mr. James Dillon, Minister of Agriculture, and Councillor P. J. Cahill, P.C., Lord Mayor of Dublin. The toast of "Ireland" was proposed by Mr. R. Thompson, after which Mr. Costello proposed the joint toast of "The Irish Food Manufacturers' Federation" and "The Food Group of the Society of Chemical Industry (Great Britain)." This toast was supported by Mr. Dillon, who, in a forthright speech, said that he had told the British Minister of Food that they could have canned beef before anyone else in the world and have it for less money than others would be prepared to pay for it. This was acknowledged by Mr. R. Thompson and Dr. E. B. Hughes, F.R.I.C., our chairman. The toast "Our Guests" was proposed by Councillor P. J. Cahill, P.C., and Mr. W. H. Lamb, Vice-President of the Irish Food Manufacturers' Federation, and was acknowledged by Dr. H. E. Cox, F.R.I.C., and Professor T. S. Wheeler, D.Sc. A memorable evening.

Bacon, Pork and Sausages

On Friday we visited the bacon factory of Messrs. Donelly (Dublin), Ltd., where the whole gamut of operations from the live pig to finished bacon was demonstrated. This factory has a capacity of 200 pigs per hour, but is at present working on a somewhat reduced scale. The output of the sausage department is approximately 45 tons per week, and this is being extended to 70 tons per week this year. Fresh pork is delivered to Smithfield twenty-four hours after killing, and sausages leaving the factory in the evening are distributed from six centres throughout Ireland by the following morning. A nice gesture by the company was the presentation to each member of 1 lb. of pork sausages neatly wrapped in Cellophane.

In the afternoon a visit to Trinity College, Dublin, was followed by a tour through the chemistry and bio-chemistry laboratories. We went through the College library, where the eighth-century manuscript of the Gospels, the Book of Kells, is kept, which we examined under the guidance of one of the librarians.

The end of the tour was approaching, but there was one pleasant function still to come—the Farewell Dinner at the Gresham Hotel, where the Group entertained the members of the firms and others who had so generously given us of their best. Many brilliant speeches were made and a seal was set on the spirit of friendship which had been born during the week. Another memorable evening.

The tour was a complete success in every respect, and not only must have helped to produce a better understanding between our two peoples, but also enabled scientists and food executives to get together on their various subjects.

This chronicle would not be complete without mention of the excellent work of the stewards of the parties in the different hotels—Mr. Waite at the Gresham, Dr. Davis at the Clarence, Dr. Amos at the Royal Hibernian, Mr. Barton at the Shelbourne, Dr. Nicholls at the Royal Marine, Mr. Bunker at the Russell, and Mr. McLachlan at the Standard. The synchronisation of the operations and the collecting of the members for the different functions was no easy matter. At our hotel the air was rent almost constantly by the pageboy's voice calling "Mr. Waite!"

A slightly tired Food Group was deposited on the steamer on Saturday evening. As it left on a smooth sea, we watched from the deck the Dublin mountains recede into the blue distance. *Partir c'est mourir un peu!*

Those taking part in the tour were:

Mr. & Mrs. C. A. Adams, Mr. A. N. Ainsworth, Dr. & Mrs. A. J. Amos, Mr. & Mrs. M. H. M. Arnold, Mr. R. C. Baker, Mr. H. F. Barnes & Miss Barnes, Mr. L. H. G. Barton & Mrs. V. L. G. Barton, Mr. J. S. Baxter, Miss E. I. Beeching, Mr. & Mrs. F. K. Birkett, Mrs. A. L. Booker, Mr. A. P. Buchanan, Mr. F. C. Bullock, Mr. & Mrs. H. J. Bunker, Mr. & Mrs. S. W. Butterworth, Major W. H. Cadman, Mr. W. Gordon Carey, Mr. E. Chilman, Dr. & Mrs. J. W. Corran, Dr. H. E. Cox, Miss Alice Crang, Mr. & Mrs. T. Crosbie-Walsh, Mr. & Mrs., A. J. C. Cosbie, Dr. & Mrs. J. G. Davis, Dr. C. de Worms, Mr. A. H. Dodd & Miss Dodd, Mr. J. J. Doyle, Dr. & Mrs. G. M. Dyson, Dr. & Mrs. N. Evers, Mr. & Mrs. T. H. Fairbrother, Dr. & Mrs. W. H. Gibson, Dr. H. E. Glynn, Mrs. E. Glynn, Dr. A. E. Glynn, Mr. K. L. Graham, Dr. H. N. Griffiths, Mr. & Mrs. A. N. Harrow, Mr. & Mrs. J. W. Hawley, Mr. H. Heron, Mr. & Mrs. H. E. Holland, Dr. & Mrs. E. B. Hughes, Dr. E. Lewkowitsch, Mr. & Mrs. G. E. Maddison, Mr. & Mrs. H. B. Marston, Mr. & Mrs. T. McLachlan, Mr. & Mrs. G. MacLaren, Mr. & Mrs. T. McLean, Mr. & Mrs. H. Mears, Mr. Henry Morton, Dr. J. R. Nicholls, Mr. & Mrs. R. J. Nicholls, Mr. L. Okun, Mr. & Mrs. T. N. Richardson, Miss D. Rutter, Miss M. D. Sacker, Mr. & Mrs. S. B. Tallantyre, Miss S. Taylor, Mr. & Mrs. B. D. Thornley, Mr. & Mrs. T. H. Turner, Mr. D. W. H. Waite, Mr. & Mrs. W. B. Walker, Mr. W. A. Whitley, Dr. R. C. Wright, Mr. & Mrs. J. C. G. Holman, Mr. J. Plunkett Bowley.

Chemical Methods for the Estimation of Vitamins

LESLIE J. HARRIS, Sc.D., D.Sc., F.R.I.C., L. W. MAPSON, M.A., Ph.D., E. KODICEK, M.D., Ph.D., THOMAS MOORE, D.Sc., Ph.D., and V. H. BOOTH, Ph.D.

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In this article, based on a paper read at the Eleventh International Congress of Pure and Applied Chemistry held in London during July, 1947, the authors examine the reliability and the possible sources of error in the various chemical methods which are now available for estimating vitamins.

IN the estimation of vitamins it seems desirable to take a stand between two extreme attitudes. On the one hand, some physiologists are still inclined to regard all chemical tests with distrust and to pin all their faith on animal assays. On the other hand, some chemists are, in our view, perhaps insufficiently discriminating in the choice and application of chemical tests. Vitamin determination is a highly specialised and sometimes a somewhat complicated matter, and it is necessary both to have a thorough understanding of the underlying theoretical principles and to be ready to modify the procedure as occasion demands.

Criteria of Reliability

Seven possible criteria may provide the means of checking the accuracy of any given chemical method as follows:

1. Quantitative recovery of added vitamin.
2. Result too high: interference from related substances to be overcome.
3. Result too low: interference from inhibitory substances to be overcome.
4. Agreement with other chemical (or physical) methods.
5. Agreement with other microbiological methods.
6. Agreement with other biological methods.
7. High reproducibility and low standard error.

If each of these is satisfied in some detail little or nothing more can be suggested. Some unexpected flaw or exception must be awaited. In the meantime the onus of proving that the method is unreliable must rest with the critic. Most of the methods discussed in this article have been examined fairly systematically from the standpoint of these seven criteria, whenever applicable.

It has to be recognised, however, at the outset that the amount of a vitamin present in a food is not always identical with its biological activity (*i.e.* with its vitamin potency) as tested on an animal. For example, the apparent antirachitic activity of a food for an experimental animal will depend not only on its vitamin D content but also on the presence or absence of an anti-vitamin, on the Ca and P content and ratio, on its acid base properties, and many other factors; and, indeed, on which species of animal is used for the test (D_2 and D_3 being about equally efficacious for the rat, but not for the chick). Similarly, the apparent anti-pellagra activity of a food depends not only on the niacin content but also on the tryptophane content and on other things, and on the extent of biosynthesis. In the case of vitamin A, the degree of absorption and utilisation will determine the result of the animal test, nor has any given provitamin (carotene, etc.) any definite, fixed biological activity in proportion to that of the pre-formed vitamin. Again, the apparent vitamin B_1 activity of a food depends not only on its B_1 content but may also be influenced by the B_1-sparing action of any fat present, by the calorie intake of the animal, or by the presence of an anti-vitamin.

It is, therefore, illusory to regard an animal test as necessarily the final criterion of actual vitamin content; it is rather the measure of its effective activity, and for the one particular species employed.

Ascorbic Acid

Two necessary conditions[1,2] for the estimation of ascorbic acid by titration with 2,6-dichlorophenol-indophenol are (*a*) that for the preliminary extraction a procedure should be used (*e.g.* with metaphosphoric acid) which inactivates the ascorbic oxidase present in many vegetable and other tissues, and which retards oxidation in the extract; and (*b*) that the titration itself should be performed

rapidly, and in an acid reaction, in order to exclude interference from glutathione and other reducing agents.

Provided these precautions were taken, the chemical values for the usual common carriers of vitamin C, including numerous fruits and vegetables (raw, canned, or boiled) agreed with the results of biological assay (growth test and dental-histology methods)[1, 2] (Table 1).

TABLE 1.

ASCORBIC ACID.

Examples of Agreement between Chemical and Biological Values.

Description.	*Vitamin C Content, mg./100 g.*	
	Chemical Method.	*Biological Method.*
Dried cabbage	460	463
Black currants	237	194
Black currant purée ..	120	138
Potatoes, new	35	37
Cabbage, cooking water ..	25	25
Potatoes, old	9	7

Also, search for interfering substances in such foods, *e.g.* by comparison of the velocity of reaction with indophenol at various *p*H values, gave negative findings almost without exception.[3]

No evidence could be found of "bound ascorbic acid," nor were there appreciable amounts of dehydroascorbic acid in such natural products.[2] Conclusions apparently to the contrary can be attributed to failure to protect against oxidation during analysis.[2]

Estimation in Presence of Reductone-like Substances

Certain processed foodstuffs (viz. caramelised and fermented products) may, however, contain[4] interfering substances of the type of reductones. Two methods have been developed for the quantitative differentiation of ascorbic acid from such interfering substances in caramelised dehydrated foods: (*a*) by comparing their rate of condensation with formaldehyde[5] (Fig. 1), and (*b*) by measuring their rates of reaction[3] (constant flow apparatus[6]) (Figs. 2, 3, 4, and Tables 2 and 3). By the constant flow method the extract containing the ascorbic acid is passed into one limb of the horizontal T-piece, and the indophenol reagent into the other. The solutions mix instantaneously as they meet, and then the mixed solutions continue to flow along

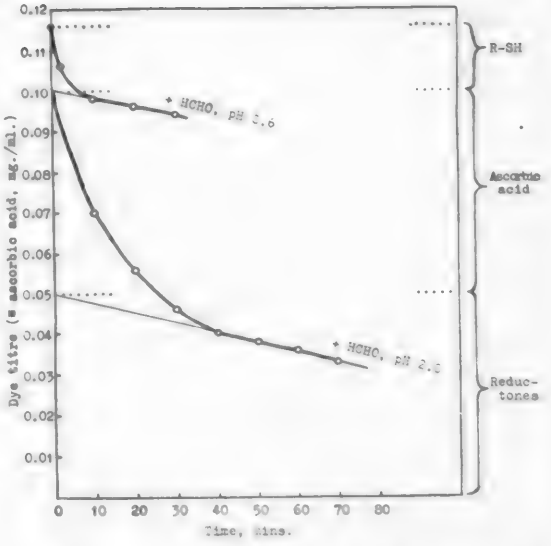


Fig. 1.—Determination of ascorbic acid in presence of RSH and reductones by the formaldehyde method. Reductones and certain thiol compounds resemble ascorbic acid in reducing indophenol dye. One method by which they can be distinguished depends on the different rates at which they condense with formaldehyde and thereby lose their reducing power. In the example illustrated above, measurements are made, first (a) of the total reducing titre and then (b) and (c) of the rates of condensation with formaldehyde at pH 0·6 and at pH 2·0. This permits of the differential estimation of all three substances in the manner shown.

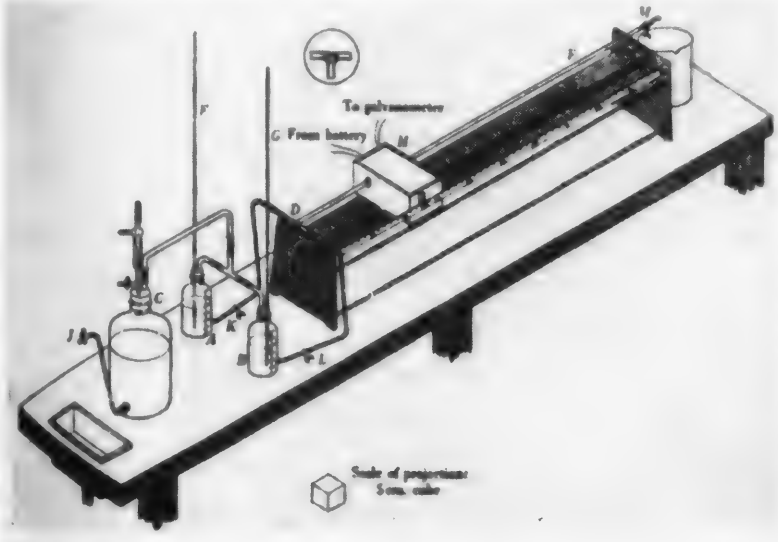


Fig. 2.—Details of the apparatus used for determination of ascorbic acid by the "constant flow" method.

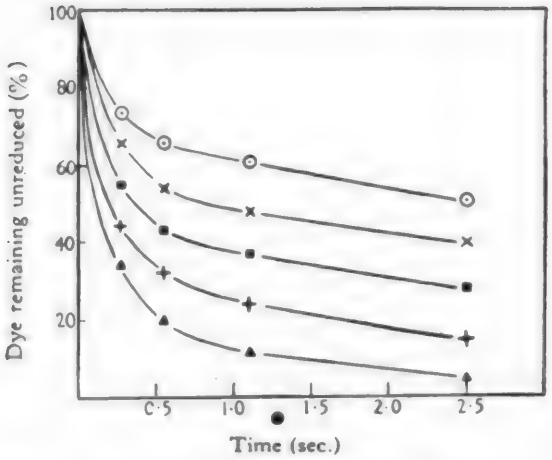


Fig. 3.—Rates of reaction of ascorbic acid, "gluco-reductone," and mixtures of the two with the indophenol dye. (pH 3·5, temperature 20° C., strength of indophenol dye and total reductants = 0·040 mg. of ascorbic acid/ml.) ■ ——⊙ Gluco-reductone 100 per cent., ascorbic acid 0 per cent.; ×——× gluco-reductone 75 per cent., ascorbic acid 25 per cent.; ■ ——⊙ gluco-reductone 50 per cent., ascorbic acid 50 per cent.; +——+ gluco-reductone 25 per cent., ascorbic acid 75 per cent.; ▲——▲ gluco-reductone 0 per cent., ascorbic acid 100 per cent.

the long tube, which is also horizontal. The ascorbic acid discharges the colour of the indophenol dye, the reaction taking place at a definite known rate. The speed at which the mixed solution passes along the tube being known, it is possible, by measuring the colour at a given point along the tube, to tell how much dye has been reduced in any given time interval, and hence how much ascorbic acid is present. Other substances

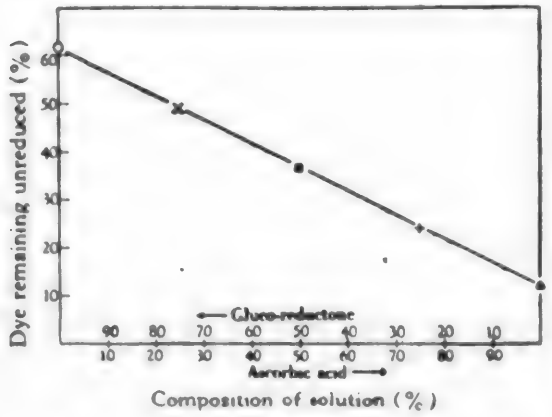


Fig. 4.—Reference graph for determining relative amounts of ascorbic acid and "gluco-reductone" present in mixtures of the two, from the amount of dye found to be reduced in a given time. (Time 1·1 sec.; temperature 20° C.; pH 3·5; solutions of mixed reductant and dye each equivalent to 0·040 mg./ml. of ascorbic acid.)

TABLE 2.

VELOCITY CONSTANTS OF VARIOUS REACTANTS WITH INDOPHENOL DYE (20° C., *p*H 1·4 AND 3·5).

Interfering substances, occurring naturally in foodstuffs, have different constants from those of ascorbic acid, and hence can be differentiated from it.

	K, Calculated, in all Cases, for 10^{-3} *N* × *Sec., and as for a Bimolecular Reaction.*	
	*p*H 1·4	*p*H 3·5
Ascorbic acid	30 ± 2	30 ± 2
*iso*Ascorbic acid ..	30 ± 2	30 ± 2
Hydroxytetronic acid ..	35 ± 2	35 ± 2
Reductic acid	17 ± 1	17 ± 1
Dihydroxymaleic acid ..	167 ± 2	25 ± 1
Reductone (Euler) ..	0·54 ± 0·08	0·54 ± 0·08
Cysteine	0·048 ± 0·06	0·048 ± 0·06
Sulphite	0·20 ± 0·02	0·20 ± 0·02
Thiosulphate	25 ± 1	1·5 ± 0·04
Ferrous ions	86 ± 2	7·4 ± 0·8

also react with the dye, but at a different rate (under suitably controlled conditions), and can hence be distinguished as indicated in Figs. 3 and 4. The results so obtained were checked biologically[3] (Table 4).

TABLE 3.

RATES OF REACTION OF ASCORBIC ACID, AND OF EXTRACTS MADE FROM FRESH FRUITS AND VEGETABLES, WITH INDOPHENOL DYE (20° C. AND *p*H 3·5, CONC. = 0·040 MG. OF ASCORBIC ACID PER ML.).

The rates of reaction are the same and the reducing substance in the fresh fruits and vegetables has the properties of ascorbic acid.

Material Tested.	*Percentage of reaction completed after*			
	0·28 *Sec.*	0·55 *Sec.*	0·78 *Sec.*	1·1 *Sec.*
Ascorbic acid ..	64	80	84	87–88
Parsley	65	78	84	86
Brussels sprouts ..	65	80	85	89
Marrow-stem kale ..	63	79	84	86
Potatoes	63	78	83·5	86
Curly kale	64	79	84·5	86·5
Broccoli leaf ..	64	76	83	87
Spring cabbage ..	66	78	83	86
Broccoli	63·5	77	82	86·5
Spinach	66·5	79·5	84	88
Lettuce	65	79	83·5	88
Peas	65	80	84	88
Nasturtium leaves ..	64	80	83·5	88
Carrot tops	64	78	83·5	86
Orange juice ..	65	79	84	88·5
Tomatoes	63	78	83·5	86
Cress	66	79	84	87
Lemon juice ..	64	77	82	86·5
Grass	64·5	79	84	87
Gooseberries ..	66	79	84	88
Strawberries ..	63	80	84	88
Raspberries	64·5	78	—	86
Red currants ..	65	77	83	86
Black currants:				
whole (sample 1) ..	62	73	80	83
whole (sample 2) ..	58	72	—	81
skinned	64·5	78	83	87
Black-currant skins:				
sample 1	44	59	—	73
sample 2	41	48	—	62
Walnuts, unripe				
whole: sample 1 ..	64·5	78·5	84	87
sample 2 ..	64	78	—	87

TABLE 4.

ESTIMATION OF ASCORBIC ACID BY CONSTANT FLOW METHOD, SHOWING AGREEMENT WITH BIOLOGICAL ASSAYS.

Test Material.	Category.	Presence of		Result of Chemical Analysis (mg./100 g. (av.)).		Result of Biological Assay, Ascorbic Acid (mg./100 g.).	Biological Value as Per Cent. of Chemical Value.	Reference.
		Ascorbic Acid.	Interfering Substance.	Ascorbic Acid.	Interfering Substance (expressed as equiv. of Ascorbic Acid.)			
New potatoes ..	Raw	+	0	35	0	37	106	(a)
Cabbage water ..	Cooked	+	0	25	—	25	100	(a)
Black-currant purée	Processed	+	0	120	—	138	115	(a)
Cabbage, dehydrated	Processed (not caramelised)	+	0	460	0	463	101	(a)
Cabbage, dehydrated	Excessively caramelised	—	+	115	160	114	99	(b)
Carrot, dehydrated	Excessively caramelised and inactivated	0	+	0	220	nil	—	(b)
Dried egg yolk ..	—	0	0	0	0	nil	—	(c)

Gluco-reductone, reductic acid, and hydroxytetronic acid were tested biologically and found inactive (*b*).

References: (*a*) Harris and Olliver (1942). (*b*) Cruickshank *et al.* (1947). (*c*) Unpublished work.

Methods for Use with Pigmented Extracts or in Presence of SO_2

With extracts containing natural pigments the end-point can be accurately determined potentiometrically by the use of a special electrode[7] (Figs. 5, 6, and 7). SO_2 present in preserved foods must be removed, *e.g.* by treatment with acetone[2,8] or by evacuation[2] before titration.

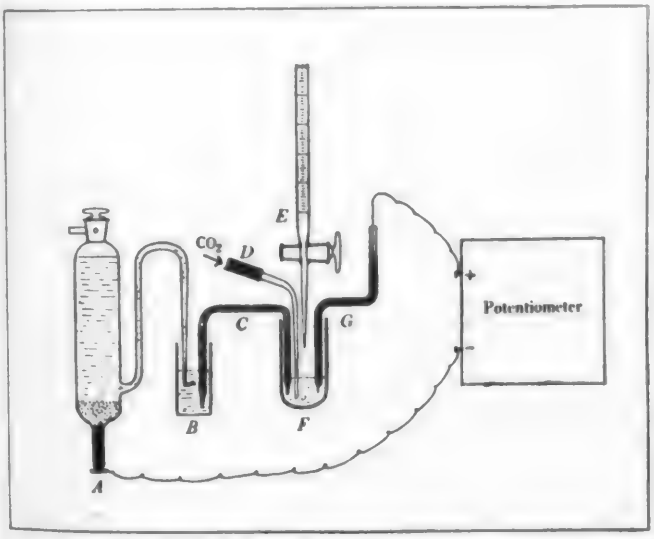


Fig. 5.—Apparatus used for potentiometric determination of ascorbic acid. A: saturated-KCL calomel half-cell; B: connecting vessel with saturated KCL; C: agar bridge; D: CO_2 or N, bubbling tube for agitating extract during titration; E: microburette; F: vessel containing extract; G: needle electrode.

Saturation Test and other Methods

In urine a large part of the blank titration before test-dosing may be due to non-specific reducing agents. However, this does not affect the validity of the method of determining human nutritional status by counting the number of days of test-dosing needed to bring about saturation, since the amount of ascorbic acid excreted on attainment of saturation is out of all proportion to the blank "resting level."[9]

For estimating ascorbic acid in blood, Roe and Kuether's method[10] can be recommended. This involves oxidation to dehydroascorbic acid, coupling with 2,3-dinitrophenylhydrazine, with the production of a red colour in 85 per cent. H_2SO_4, which can be estimated photometrically.

The results obtained by the polarographic method[11] have been compared with those in the dye and potentiometric methods. Good agreement was found for fruits and vegetables, but reductones could not be differentiated.[12]

Aneurin

In the thiocrome test[13] attention to the various points of technique described in the original papers[14, 15] serves to increase the reliability and accuracy of the results.

Results by the improved procedure[14] agreed well with biological assays (bradycardia, convulsions,

TABLE 5.

DETERMINATION OF VITAMIN B_1. EXAMPLES OF COMPARISONS OF CHEMICAL AND BIOLOGICAL RESULTS.

	Vitamin B_1, I.U. per g.	
	Chemical (Thiochrome: Harris and Wang).	*Biological (Bradycardia).*
Yeasts and Yeast Products:		
Yeast, high potency, dried	200	191
,, high potency (74 per cent. H_2O)	57	66
Yeast extract, "M," stored	4·8	5·6
,, ,, "M," retail	4·6	7–8
,, ,, "M," retail	7·0	8·9
,, ,, "Y," wholesale	13·4	13·4
Pork and Bacon:		
Pork, raw, dried powder	7·67	9·0
,, raw, dried powder	8·07	7·6
,, roast, dried powder	5·13	4·7
Bacon	4·0	3·7
Cereals:		
Wheat and Wheat Products:		
Wheat-germ, proprietary	9·5	8·4–9·6
Whole meals (different varieties and countries of origin) specimen 1	1·7	1·73
,, ,, specimen 2	1·3	1·27
,, ,, specimen 3	1·3	1·20
,, ,, specimen 4	1·1	1·48
,, ,, specimen 5	1·3	1·35
,, ,, specimen 6	1·1	1·23
,, ,, specimen 7	1·0	1·0–1·1
,, ,, specimen 8	1·2	1·2–1·4
,, ,, specimen 9	1·0	1·0–1·3
Bread, white, fortified, formula 1	0·44	0·48
,, white, fortified, formula 2	0·4	0·47
,, white, fortified, dried crumb, formula 1	0·74	0·77
,, white, fortified, dried crumb, formula 2	0·60	0·61
,, yeast-enriched (1·65 g./100 g.)	1·42	1·45
,, yeast-enriched (1·20 g./100 g.)	1·49	1·47
,, yeast-enriched (0·53 g./100 g.)	0·56	0·61
,, wheatmeal, dried crumb	1·08	1·1
,, wheatmeal, dried crumb, special formula	0·98	1·1
,, whole wheat, dried powder	0·80, 0·87	1·31
Wheatmeal biscuits, raw materials (1)	0·67	0·78
,, ,, raw materials (2)	0·80	0·74
,, ,, baked with $(NH_4)_2CO_3$, experimental (1)	0·67	0·71
,, ,, baked with $(NH_4)_2CO_3$, experimental (2)	0·60	0·56
,, ,, baked with $(NH_4)_2CO_3$, commercial (1)	0·70, 0·75	0·77
,, ,, baked with $(NH_4)_2CO_3$, commercial (2)	0·60, 0·62	0·92
,, ,, baked with $(NH_4)_2CO_3$, commercial (3)	0·99	1·0
,, ,, baked with $NaHCO_3$ and $(NH_4)_2CO_3$, experimental (1)	0·25	0·17
,, ,, baked with $NaHCO_3$ and $(NH_4)_2CO_3$, experimental (2)	0·30	0·29
,, ,, baked with $NaHCO_3$, commercial	0·3	$\geq$0·3
Barley:		
Pearl, retail (1)	0·44	0·62
,, retail (2)	0·44	0·41
Fruits and Vegetables:		
Spinach, dried powder	1·53	1·69
Orange juice, partly evaporated	0·66	0·64
Potato, dried powder	0·57	1·03
,, Majestic	0·3	0·50
,, Majestic	0·32	0·39
Cauliflower	0·26	0·34
Dairy Products:		
Eggs (hen), yolk, raw, dried	2·35	2·73
,, ,, white, cooked	0·05	$<$0·1
Milk (cow's) powder, skimmed	0·85	0·89
Liver:		
Beef, roasted, dried powder	0·7	1·27
,, raw, dried powder	0·93–1·1	1·67–1·74
Fish Products:		
Fish "drip," concentrated	0·30	0·41
Herring, muscle, fresh, raw	0·03	0·04

and growth methods), over seventy comparisons being made with products varying in activity from 190 I.U. to 0·1 I.U. per g. (Some of these are shown in Table 5.)

Nicotinic Acid and Amide

The *p*-aminoacetophenone method[16,17] depends on a König reaction[18] between free nicotinic acid, CNBr, and *p*-aminoacetophenone used as the aromatic amine. By this method known increments of nicotinic acid (20, 40, 60 mg.) are added to the extract, and the increase of colour for each such addition is determined. There is a straight-line relation between the colour intensity and the total amount of nicotinic acid present. Hence by extrapolation to zero the amount originally present in the extract can be estimated (*e.g.* 11·0 mg. and 11·5 mg. in the duplicate determinations illustrated). In any given determination the exact degree of colour, for a given amount of the vitamin, will vary with the *p*H, salt concentration, and other factors, but by the procedure shown, using an internal standard, the amount can nevertheless be ascertained.

We have found good agreement between the chemical values and the results of microbiological assay;[19] in a few cases the chemical results were checked also against a curative growth test with puppies[20] and agreement was again good (Tables 6 and 7).

TABLE 6.

NICOTINIC ACID.

Agreement between Chemical and Microbiological Values.

	Nicotinic Acid, μg./g. (or ml.).	
	Chemical Method	*Microbiological Method.*
Wheat bran, from 85 per cent. extraction	218·0	250·0
Kipper, dehydrated	138·0	142·0
Herring, dehydrated	99·3	81·0
Potato, spray-dried	90·0	102·0
Wheat grist, Manitoba : English, 62·5 : 37·5	74·9	79·8
Wheat germ	65·5	63·3
Beef, muscle	36·7	36·7
Wheat flour, 85 per cent. extraction	24·5	22·9
Wheat flour, national, self-raising	23·2	20·9
Pea meal	23·3	25·6
Semolina	19·2	17·1
Cocoa	16·1	15·9
Maize meal	15·5	15·1
Milk, cows', spray-dried	9·4	9·5
Oats, ground	6·2	6·7
Carrot, fresh	4·3	6·3
Egg, spray-dried	3·9	3·2
Milk, cows', fresh	0·9	1·0
Urine, rat	1·2	0·9

Riboflavin

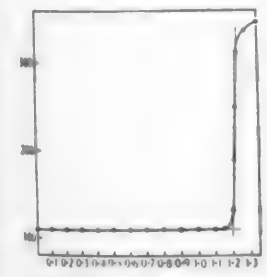
Using a modified technique[21] in the fluorimetric method good agreement was found with the results obtained by a microbiological procedure,[22] the substances tested varying in activity from 50 μg. to 0·3 μg. per g. (Table 8).

Vitamin A

The choice of the most suitable method of extraction is important and depends on the material. For example, alkali digestion[23] works well with liver, but is less satisfactory for blood plasma. The extracted fat must be saponified, unless the concentration of vitamin A is very high (*e.g.* as with halibut liver oil or human liver fat).

In the $SbCl_3$ test the presence of unsaturated fats[24] or indol derivatives[25] will inhibit the development of colour. Carotenoids will contribute to the colour and must either be corrected for or removed. The extent of the correction will vary according to both the optical apparatus used and the material under examination.[26] Removal of carotene is advisable[27] when it is present in great excess, *e.g.* in extracts of egg yolk or plasma of Jersey cows.

In the ultra-violet absorption test the presence of unsaturated fats and some other absorbing materials will cause too high values.



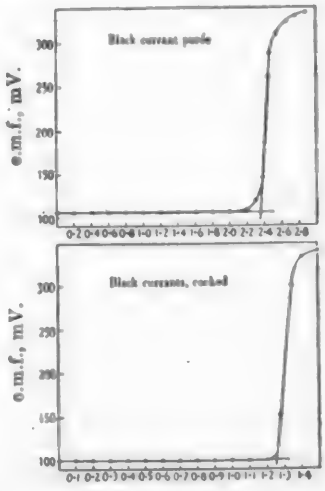


Fig. 6—Left: Potentiometric titration curve for pure ascorbic acid showing method of determining end-point (point of origin of sharp upward curve).
Fig. 7.—Right: Potentiometric estimation of ascorbic acid in black-currant preparations.

TABLE 7.

NICOTINIC ACID.

Agreement of Chemical and Biological Values.

	Nicotinic Acid, μg. per g.	
	Chemical Method.	*Biological Method.*
Muscle, rat	144	135
Coffee, ground	45	47·5
Milk, cows'	0·6	1·1

Carotene and Vitamin E

To prevent loss, rapid sampling and extraction into a cold solvent are desirable when applying the colorimetric method. Provided a satisfactory adsorbent be used saponification is not necessary. A method[28] which gives reliable results involves direct extraction with petrol-acetone mixture, followed by chromatography on a stable mixture of aluminium oxide plus sodium sulphate and elution of the carotene.

The following considerations are of consequence in the estimation of vitamin E: (1) Only the free alcohol (tocopherol) reacts with Emmerie's[29] reagents (ferric chloride and α,α' dipyridyl). (2) Considerable loss of the vitamin may occur during saponification (with either vitamin esters or natural fats), and this can be prevented by addition of excess of pyrogallol, which can subsequently be removed from the unsaponified residue by washing.[30] (3) Non-specific reactants, carotenoids, and also other substances present in many vegetable oils can be removed by adsorption on alumina.

TABLE 8.

RIBOFLAVIN.

Agreement of Chemical and Microbiological Values.

	Microbiological Method (Kodicek). μg./g.	*Fluorimetric Method (Kodicek and Wat μg./g*
Yeast (dried)	51·0	51·8
,, ,, ...	44·9	51·2
Yeastrel	40·3	42·6
Sweet pepper (Kenya)	24·6	26·2
Milk, cows' (fresh)	17·4	17·5
Milk powder (skimmed)	17·2	17·7
,, ,, (full cream) ..	14·6	15·0
Liver, sheep (fresh)	17·2	17·5
,, calf (fresh)	10·7	13·3
Egg powder (dried)	13·8	12·8
Wheat germ	8·3	7·6
Meat (dried)	5·8	6·2
,, ,, ...	5·1	5·7
Soya bean (Manitoba brown) ..	3·7	3·9
Wheat bran	—	3·6
Mashed potato powder (dried) ..	1·04	1·1
Wheat flour, 1945 (Manitoba : English 50 : 50)—		
100 per cent. extraction	1·02	1·04
85 per cent. extraction	0·60	0·67
80 per cent. extraction	0·50	0·50
75 per cent. extraction	0·33	0·38
70 per cent. extraction	0·38	0·36
,, ,, 1946, 100 per cent. extraction ..	0·85	0·90
80 per cent. extraction ..	0·57	0·71
70 per cent. extraction ..	0·27	0·19
National flour, 1945	0·55	0·60
Patent flour	0·35	0·36

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Figs. 2, 3, and 4 and Tables 2, 3, and 4 are based on Harris and Mapson, *Brit. J. Nutrition*, 1947, **1**, 7-38; Figs. 5, 6, and 7 are reproduced from Harris, Mapson, and Wang, *Biochem. J.*, **38**, 1942.

The Fishery Industries of North America

PART IV.—FISH MEAL AND OIL

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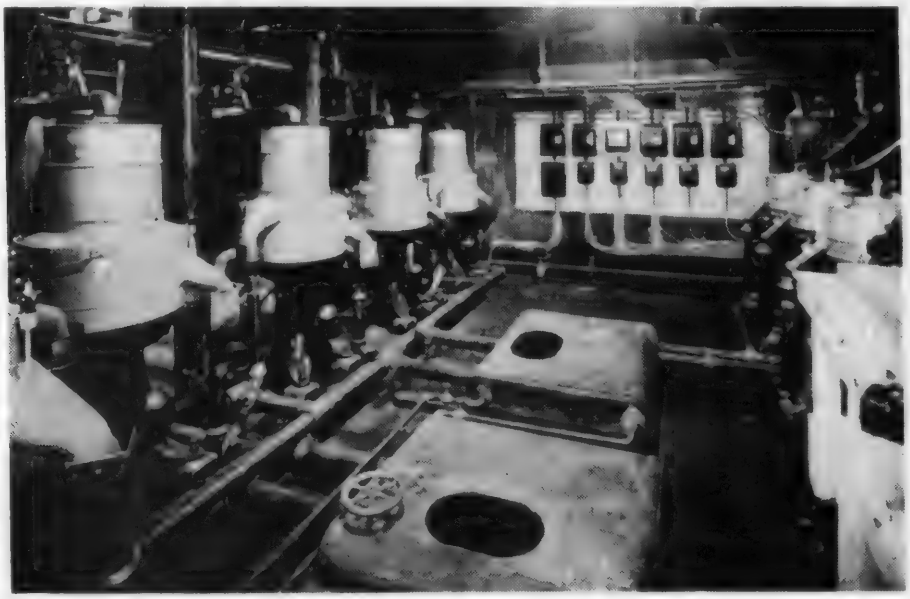
The fish meal industry of North America differs from that in this country in important respects. In the first place, the great bulk of the raw material for fish meal production in U.S.A. and Canada is oily, whereas in this country it is mainly non-oily "white" fish waste. Secondly, in U.S.A. and Canada large quantities of some species of fish are caught solely for reduction to meal and oil, whereas in Great Britain the only whole fish going to reduction plants are either fish condemned as unfit for food, or fish surplus to the markets' capacity to handle.

FISH meal and oil production are on a larger scale in North America than in Great Britain. This not only applies to the number of plants, but also to the capacity of the individual unit machines. Thus one continuous drying unit in this country often has a capacity of 1 ton of fish per hour. An average continuous unit in U.S.A. or Canada can handle 15 tons of fish per hour. The actual size ranges from a capacity of 2 tons per hour up to 20 tons per hour.

Fish meal and oil are made in large quantities on both coasts. On the Atlantic coast there is the menhaden industry, employing a fish not used at all as a food. There is a considerable production of white fish meal, especially in New England and the Canadian maritimes, and a large production from cannery offal of such species as herrings (canned as sardines) and mackerel. There is, in addition, considerable oil and meal production from filleting waste in the redfish industry of New England.

On the Pacific coast almost all of the raw material is oily. In the north, salmon offal from the canneries is important, and much of the catch of herring off Alaska and British Columbia goes direct to reduction plants. All the Canadian catch of sardines (pilchards) goes for reduction, as does much of that caught off California (in addition to sardine cannery offal). Other oily offal obtained on a considerable scale includes that from the tuna canneries, and there is a fair amount of oily filleting waste available from certain species such as rockfish.

Since many of the factories processing white fish offal also handle oily offal, their plant is often designed for the latter and adapted for use on non-oily



Fish oil separators in a floating factory.

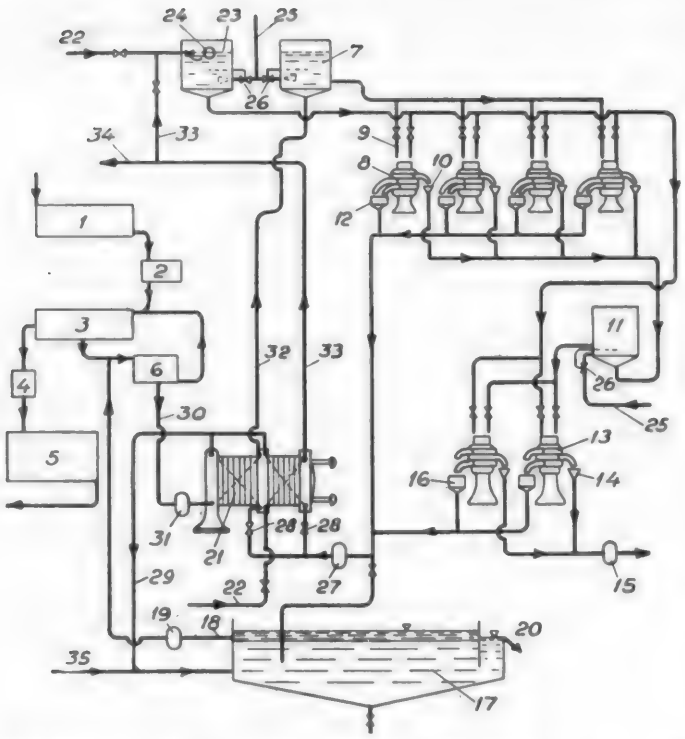


Diagram of a typical plant showing: 1. *Cooker.* 2. *Pre-strainer.* 3. *Fish press.* 4. *Crusher or grinder.* 5. *Drier.* 6. *Strainer.* 7. *Buffer tank for press liquid.* 8. *Separator.* 9. *Swingable feed pipe.* 10. *Oil discharge.* 11. *Buffer tank for oil.* 12. *Discharge for glue water and sludge.* 13. *Oil purifier.* 14. *Oil discharge.* 15. *Clean oil pump.* 16. *Glue water discharge.* 17. *Drain tank.* 18. *Oil discharge from drain tank.* 19. *Pump.* 20. *Glue water discharge from drain tank.* 21. *Plate heat exchanger for recovering heat from glue water.* 22. *Cold water inlet pipes.* 23. *Hot water tank.* 24. *Float valve for automatic control of water level.* 25. *Steam pipes for heating.* 26. *Thermostatic steam control valves.* 27. *Glue water pump to heat exchanger.* 28. *Regulating valves.* 29. *Glue water from heat exchanger.* 30. *Press water from strainer.* 31. *Pump.* 32. *Press water from heat exchanger.* 33. *Warm water from heat exchanger to hot water tank.* 34. *Warm water for various purposes.* 35. *Pipe for blood water and self-pressed oil from the bins.*

offal when required. It seems preferable, therefore, to commence by describing the equipment and operations used for oily fish. This is essentially the same for all species, and a factory will, wherever possible, use all kinds of raw materials in an effort to prolong the operating season. Thus in British Columbia the salmon and herring fisheries overlap. Pacific sardine factories are often much worse off, and commonly have only a very short season each year.

Description of Typical Plant

The typical plant in all areas includes an open-steam cooker, a screw press, settling tanks or centrifuges to handle press liquor, and a continuous rotary drier. Fish arriving at the reduction plant may either go continuously and directly to the cooker (perhaps *via* a hacker), *e.g.* offal from some salmon canneries, or may first go to temporary storage in large concrete bins, from which a worm continuously transfers it to the cookers. Storage is never prolonged, usually being less than twenty-four hours.

The cooker consists of a very long **U**-shaped trough, or sometimes a cylindrical tube, provided internally with a conveyor worm. Numerous pipes admit open steam into the cooker throughout its length. This steam is usually at low pressure, *e.g.* 5 to 10 lb., and there is either no actual steam pressure at all in the cooker, or not more than 5 to 10 lb., according to design and practice. Cooking time is usually within the range fifteen to twenty-five minutes, and is quite critical according to the species of fish and the freshness of the raw material. Overcooked fish is too soft and there is excessive loss of meal in the press liquors, and bad emulsions, while undercooked fish will not give a proper yield of oil on pressing. In a few plants the cooker is provided with a steam jacket as well as open steam jets.

There is, naturally, a great deal of free water in the cooked fish, partly derived from condensed steam, and it is common to fit an extension to the cooker containing a draining screen, where much of this free liquor is strained off. This is mixed with press liquor. The cooked fish are fed by gravity to the screw press, usually situated immediately below the cooker. These presses are of the expeller type, in which pressure is exerted between the propelling worm and the casing. The latter is perforated, either by holes or by longitudinal slots. In both cases the perforations taper so as to be wider on the outside, thus preventing choking by fine solids. Various types of worm are used, and increasing pressure on the fish as it passes through may be achieved by any of the following methods, or a combination of them: (*a*) a shaft in two sections, the second rotating more slowly than the first; (*b*) a tapered shaft, becoming progressively thicker; (*c*) a worm of diminishing pitch.

The press cake, commonly containing about 50

Fish oil separators in a fish meal factory.

per cent. of water and about 5 per cent. of oil, is conveyed continuously to the driers, usually passing over a simple breaker on the way. Various types of drier are in use, and these merit separate consideration.

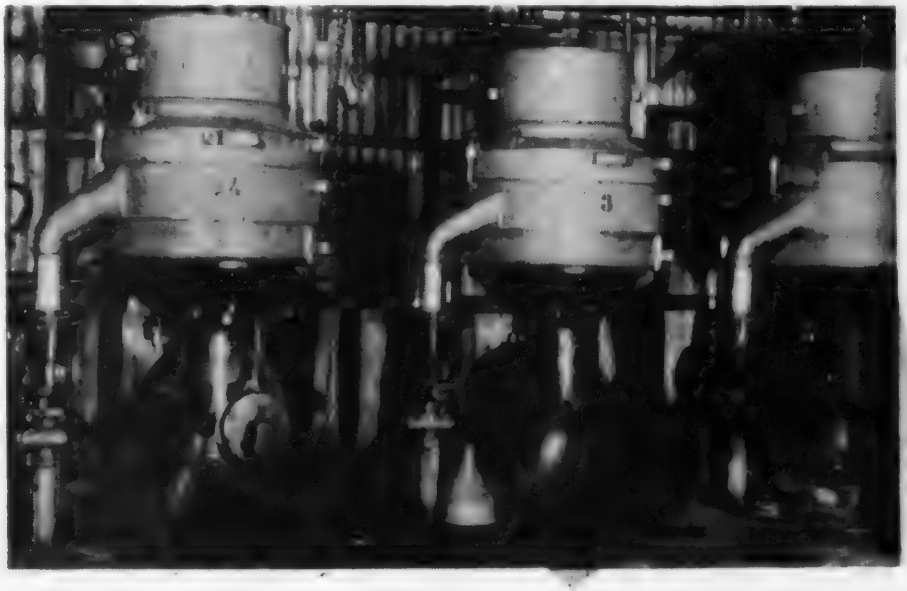
The Steam Tube Drier

Provided internally with closed steam pipes running longitudinally, the steam tube drier is a rotating, inclined, cylindrical vessel. The press cake is fed in at the top and tumbles about among the steam pipes, finally emerging dry at the lower end. Steam pressure is commonly about 30 to 40 lb., and drying time may be from forty minutes up to three hours. There are various models of these driers, incorporating different methods of removing condensate from the tubes. In some the tubes are double, live steam passing up an inner tube and condensate flowing back down an outer concentric tube. In others each tube is single and condensate returns through the space between an inner and outer shell of the whole drying cylinder. There are other methods in use also.

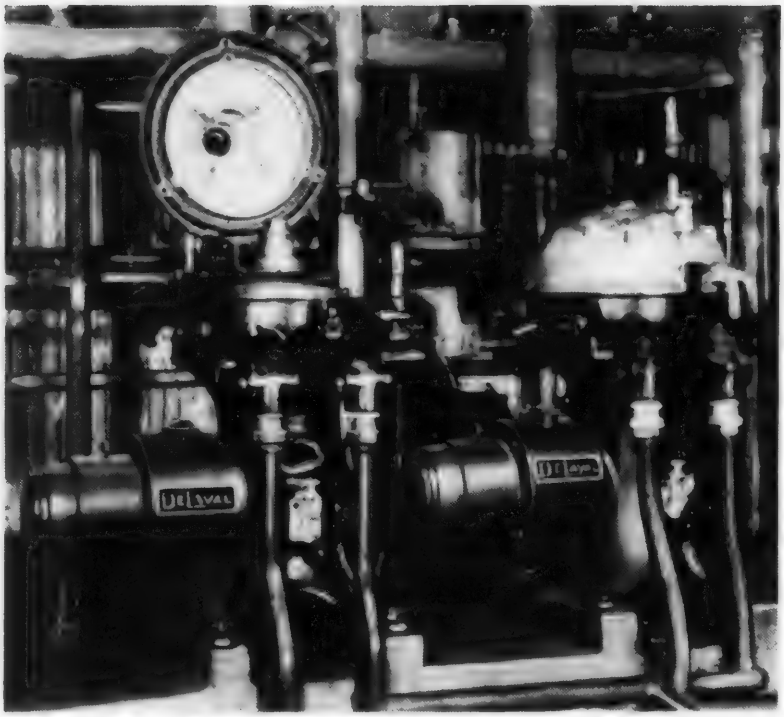
The Flue Gas Tube and Flame Driers

Flue gases are passed through the tubes instead of steam. In other respects the flue gas tube drier is similar to the steam tube drier.

There are several models of the flame drier, but the most usual one involves an inclined rotating cylinder fitted internally with flights or angle irons, which cause the meal to tumble as it passes through



A larger type of fish oil separator.



Oil purifiers in a fish preparation factory.

the drier. At the upper end of the cylinder a flame, produced either from oil or from natural gas, is directed along the drier. A little beyond the end of this flame is the point of entry of the wet press cake, which thus meets a mixture of hot air and flue gas, and travels in parallel flow with the air stream to the discharge at the lower end. The high rate of evaporation from the wet press cake prevents charring at the high initial air temperature. Air leaving the drier is commonly about 230° F. Drying time is much less than in the steam tube driers, ranging from five to fifteen minutes.

Superheated Steam Drier

Although not in widespread use, the superheated steam drier can be seen in operation at one factory, and idle in another factory not now in use for this purpose. The drier itself consists of a rotating steel drum, inside of which are mounted from one to four concentric smaller drums, arranged so that the meal will traverse one drum in one direction, then fall into the next larger concentric drum and traverse that in the other direction, and so on until it is finally discharged from the base of a chamber at one end of the drier.

According to the design of the plant, and the method of operation preferred, hot air, or superheated steam, is blown into the first drum along a central pipe, where it encounters the incoming wet meal. Meal and air (or steam) travel in parallel flow to the final discharge chamber, but whereas the meal is removed from the base, the gases escape from the top, through a cyclone, and are returned to a fan feeding them into a heating chamber and thence back to the drier. The heating chamber is of brick, and fitted with natural gas burners. A stack pipe to the outside, fitted to the top of the cyclone, permits the escape of excess air or steam. At the start of operations, drying may be in hot air, but soon all the air is expelled by steam, and from then on drying proceeds in an atmosphere of superheated steam. According to design, inlet steam temperature may range from 550° F. to 800° F., and outlet steam temperature from 230° F. to 350° F. Drying time is of the order of twelve to fifteen minutes. Arrangements may be made to heat the wet meal before it enters the drier, by passing it through a jacketed pipe supplied with hot water or with steam.

Among other types of drier that may be seen in individual factories, mention should be made of the vacuum drier, usually operated batchwise as a battery of such driers. These are usually steam-jacketed cylinders provided with agitating paddles, and employing a vacuum of from 15 in. to 28 in. Drying time may be five to seven hours.

Press liquors are strained from coarse solids, usually on vibrating screens, but sometimes by means of basket centrifuges. They are then separated into oil and "stick water," either in settling tanks or, more commonly and to an increasing extent, by means of centrifuges. It is still common practice to discharge the "stick water" to waste, but it is being recovered on an increasing scale by evaporation to syrup of 50 per cent. water content, which is sold under the name "fish solubles" and is particularly valued in poultry feeding. This recovery may either be made in the fish meal factory itself, or the "stick water" may be shipped to a central evaporating plant. The first treatment involves addition of sulphuric acid, to reduce the *p*H from about 6·5 to 4·5, which prevents putrefaction by micro-organisms. The *p*H remains at 4·5 during evaporation, due to the buffering power of the proteins present. Some protein is precipitated when the acid is added, and this can

be recovered. The evaporation effects about a 15 to 1 concentration of the dilute "stick water."

The oil recovered may either be sold in its crude form to refineries, or it may be refined at the fish meal plant, especially with the larger producers. The first stage in refining is the removal of free fatty acid, by agitation with a solution of the required amount of alkali, either as sodium carbonate or as caustic soda. Agitation may either be cautious, with the object of avoiding emulsification, or, as in some plants, it may be vigorous, with deliberate emulsification to ensure speedy neutralisation. Such emulsions are then broken in a centrifuge. The neutralised oil is washed with water. For many uses the next stage in refining is the removal of stearine, by chilling the oil to some suitable temperature and then pressing.

Variation in Chilling Temperatures

The temperature to which the oil is chilled varies markedly in different factories. Much fish oil is used as a poultry feeding oil, as a source of vitamin D, and destearinating temperatures ranging from 35° F. up to 60° F. are in use. When intended for use in paints, the oil is usually destearinated at lower temperatures, *e.g.* at 32° F. or below. For use as a poultry feeding oil, fish oils are usually blended in large batches to a standard vitamin D content and then fortified with vitamin A in the form of dogfish liver oil. Neutralisation, destearination, and blending are the only refining operations usually to be seen at the fish meal plants.

White Fish Offal

As regards white fish offal, or mixed offal of any kind in small plants, the equipment in use varies markedly in different factories. In small plants the usual apparatus consists of a steam-jacketed cylinder provided with agitating paddles and often equipped with a steam-heated shaft for these paddles. It may or may not be operated under vacuum, but is always operated batchwise. Sometimes a vacuum batch drier is used deliberately to produce a meal of particularly high feeding value. Thus at one factory the meal is sold not only on a basis of its protein content, but is standardised for a whole range of vitamins and minerals. This is achieved by blending meals made from various raw materials, all being dried under a vacuum of 28 in.

After suitable pre-treatment, white fish offal can be dried in continuous rotary driers of the steam tube or flame type. This pre-treatment must be such as to reduce the moisture content to below the point at which the product is liable to stick to the heating surfaces. One method in use is to cook and partially dry the offal in steam-jacketed vacuum cookers until the moisture content is about 50 per cent., after which it is passed through a steam tube drier.

Another method is to cook and press the offal in the same way as oily offal, but special presses are needed because the large pieces of bone might well injure certain types of screw press. Thus, at one plant, a roller press is in use, giving a press cake about 1¼ in. thick. This cake is still too moist to feed directly to the rotary steam tube drier, so about two-thirds of the dry meal coming from the drier is diverted back and mixed with the press cake before the latter enters the drier. It may be noted in passing that this practice of feeding back a proportion of the dry meal, and mixing it with press cake, to reduce the danger of sticking, is also encountered in some plants processing oily fish by conventional cookers and presses. Another method of avoiding sticking and caking in some plants, again on oily offal, is to give a double cooking and pressing. With white fish offal, where the conventional screw press has not always proved suitable, another method in use is the employment of a basket centrifuge to handle the cooked fish before passing it to the drier.

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(*To be continued.*)

Plantation Crops Trade

THE British Commonwealth is on balance an exporter of rubber and cocoa to the rest of the world, although in both cases the balance is less than it was before the war. There is also an export balance for tea as compared with an import balance before the war; this export balance has arisen from increased output in Commonwealth producing countries combined with reduced consumption in Commonwealth consuming countries. There is still a large import balance on account of coffee, sugar, and tobacco.

These facts are derived from a recently published review,* which is one of a series that was issued annually by the Commonwealth Economic Committee before the war and is now being re-issued with figures covering the war and post-war years up to 1946 or 1947. The series aims at presenting, in convenient form, up-to-date summaries of production, international trade and consumption for a group of allied commodities—sugar, tea, coffee, cocoa, spices, tobacco, and rubber—with special reference to the part played by the countries of the British Commonwealth of Nations.

Since countries under Japanese occupation during the war normally account for a large proportion of the output of most of these commodities, changes in the pattern of production and trade have been far reaching, while notable contrasts are shown in consumption levels.

* *Plantation Crops.* Pp. 102+x. H.M.S.O. Price 5s. net.

Dairy Practice and Control

A SECOND edition of Harvey and Hill's *Milk Products** has just appeared, and forms a welcome companion to the second edition of the same authors' *Milk Production and Control*.† There are not many books which cover the field of the first book, and this new issue fills a definite gap in English technological literature.

The treatment is straightforward and the style easy to read. No attempt is made to probe beneath the surface, but the essential facts are clearly stated. The book should be most useful to students, factory managers, medical officers of health, sanitary inspectors, and dairy instructresses. Scientists in fields other than dairying will also find the book of value as an introduction to the manufacturing processes, but it will leave them, perhaps, unsatisfied when it comes to discussion of fundamental reasons. No help is given to the reader requiring further references, but the authors do not claim to be writing for scientists or fundamentalists. As they say in their preface, the book is written primarily as a public health textbook and, as might be expected, the subjects of standards, legal aspects, and disease are well covered.

Ice Cream

The products covered in order of matter are ice cream (80 pages); butter and margarine (60 pages); cheese (50 pages); cream (40 pages); condensed milk, evaporated milk, and dried milk (30 pages); while 20 pages are devoted to miscellaneous products. Ice cream is very thoroughly treated, but the authors are on rather shaky ground when they refer to the utilisation of surplus milk which, in normal times, would otherwise be unsaleable. It is now an officially accepted policy that milk which fails the rejection test should be returned to the farmer. Until quality payment is accepted—and it must be regretfully admitted that it seems as far off as ever—the return of bad milk to the producer is the only penalty which can be inflicted on the unsatisfactory producer. The time is surely gone when we used the phrase "fit only for manufacture."

We warmly support the authors when they press for a definition of ice cream, the tentative definitions of 1945 and 1947 being far too loose. Their suggestion of a bacterial standard is also to be commended, but it is doubtful whether a bacterial standard can be incorporated in a general definition of a product. For example, it would be difficult to incorporate a bacterial standard in a definition of milk, but designated milks already have bacterial standards. Graded ice cream might well be defined in a similar way, even using a methylene blue test.

When dealing with food values we cannot agree with the alleged requirements of a "really nutritious food"—foods vary enormously in their contents of protein, fat, sugar, salts, and vitamins, and many most valuable foods are seriously deficient in one or more of these. Even in these days, from a nutritional point of view, our diet is very mixed, and there are many valuable foods which contain considerable amounts of only one or two of these, *e.g.* butter, margarine, sugar, and cereals. Even if ice cream contained only fat and sugar, or sugar and protein, it could still be a most useful constituent of our diet. The authors rightly stress the dangers arising from the rapid ingestion of large quantities of very cold ice cream.

Carrier Infection

In their review of the public health problems connected with ice cream, the insidious danger of "carrier" infection is emphasised and attention drawn to the well-known fact that small vendors are responsible for the majority of outbreaks of disease. This state of affairs is unfortunately still true, and the average hygienic quality of the ice cream of this class, as measured by plate count and the new methylene blue test, is lower than that of the products of the large manufacturers. While we cannot permit discrimination against any one class of retailer or manufacturer, the welfare of the public must be adequately safeguarded. The general manufacture and control of the product are well described and illustrated.

The very useful chapter on cream is unfortunately of only academic interest now and likely to remain so for some time in this country. The chapter on butter and margarine is adequate as a general survey, but perhaps more attention could have been paid to the fundamental principles of butter making in the light of modern knowledge.

Cheese Manufacture

The section on cheese is the least satisfactory in the book, and possibly this is because the authors appear to have the least personal experience of this dairy product. The statement that "the perfect co-operation of bacteria, yeasts, and moulds is essential if good quality cheese is to be manufactured" will probably grossly mislead the reader, since yeasts and moulds are the last organisms whose co-operation is wanted in about 90 per cent.

* *Milk Products*. By W. C. Harvey, M.D., D.P.H., F.R.San.I., and H. Hill, F.R.San.I., A.M.I.S.E., F.S.I.A. 2nd edition. Pp. 343+viii. 80 illustrations. London. Price 30s. net.

† *Milk Production and Control*. By W. C. Harvey, M.D., D.P.H., F.R.San.I., and H. Hill, F.R.San.I., A.M.I.S.E, F.S.I.A. 2nd edition. Pp. 512+viii. 211 illustrations. London. Price 37s. 6d. net.

of the cheese made. Only the blue-veined and certain soft cheese require a certain degree of mould growth, and the number requiring yeasts is surely infinitesimal.

The bacteriology of starters and cheesemaking appears to be somewhat dated, but the authors are a little in advance of others on the biochemical side in that they state that rennet can be synthetically prepared. It is also of interest to learn that Stilton cheese were first made in the village of that name.

The chapters on condensed and dried milk give useful surveys of the manufacturing processes with a good selection of illustrations.

Among the most striking features of the book are the comprehensive discussion of public health and legislative aspects, the useful, although rather superficial and not always up-to-date, description of the manufacturing methods, and the well-chosen illustrations. The bacteriology, and especially the nomenclature, are rather old-fashioned, and the fundamental physics and chemistry of the various processes are almost completely ignored. The authors might, with advantage, give a few references to the standard textbooks and monographs at the end of each chapter.

Bottle Washing

Reactions to the companion volume are very similar, the good and bad points of both books being virtually identical. The "sanitary inspector" aspects are well covered, but the technical matter discloses some serious flaws. For example, the principles of bottle washing would be misleading to the uninformed reader—very few bottles today receive a hot pre-rinse, caustic soda at 2 per cent. to 3 per cent. water at 200° F., and treatment by superheated steam. In the description of the resazurin test it is surprising to see that the old confusion between the rejection and the grading tests is perpetuated.

The authors rightly stress the fact that one drop of raw or imperfectly pasteurised milk can infect a large bulk of pasteurised milk, but far too much fuss has been made of this point by those who go out of their way to attack pasteurisation, or certain features or certain types of pasteurising plant. Nearly half of the milk supply of the country is still drunk raw!

Both books are well produced and the type is easily read. They occupy a useful place in the literature of dairying.—J. G. D.

In conclusion, Mr. Neville said that American competition, which was exceptionally keen all over the Continent, should not be underestimated by manufacturers, and it was up to them to go after the business. If they could have the support of the Ministry of Supply, they could make their present export figures look quite ridiculous.—M. H.

World Wants British Food Machinery

"NOWADAYS, when most of the food produced has to be processed, users of food machinery and equipment at home have to make do, while we have to do more and more mending," said the chairman, Mr. E. H. Gilpin, speaking at the Annual Luncheon of the British Food Machinery Manufacturers' Association held in London recently. He was of the opinion, however, that large replacements of equipment would have to be made in this country if full use was to be made of the food produced.

Surprise was expressed by the Rt. Hon. Harold Wilson, President of the Board of Trade, that the Association, which comprised 175 firms in the various sections of the industry, came into being in the early days of the war as an export group and was not formed into a trade association until 1947. Over the past year there had been a considerable increase in the export of food machinery as compared with that of pre-war times, despite the fact that prices had risen, and they were fast approaching the target set for the fourth quarter of 1948. He emphasised that the world was anxious to buy the products of the industry, and that confectionery, grain, and biscuit machinery in particular were making a great contribution to exports. The Board of Trade were sponsoring the sending of a trade mission to Canada, which the Association had promised to lead in the autumn, to make investigations which would enable them to formulate the best methods of sales organisation for British exports. Although America dominated the market, U.K. manufacturers of certain specialised lines, such as biscuit, dairy, and grain machinery, had a high reputation in Canada.

Mr. Wilson also mentioned the great development in the scale of activities of the Export Credit Guarantee Department and the services which it had rendered to manufacturers.

As long as members could produce at a reasonable price and could offer—and keep—prompt delivery dates, he felt that they could look forward to a continued period of prosperity at home and abroad.

A brief description of his visit to South America, the purpose of which had been to review the market for British processing equipment, was given by Mr. Norman Neville, O.B.E., the Director of the Association. His investigations had revealed that while lease-lend restrictions had kept Britain out of the field of competition in South America, others had stepped in and filled their order books. He felt sure that exports could be greatly increased if they could only get deliveries, but unless manufacturers could get bigger allocations of steel, overseas orders could not be dealt with promptly.

(*Concluded at foot of preceding column*)

Vegetable Lecithin

The principal sources of lecithin are the yolk of egg, oilseeds, and nuts. Although maize oil and cottonseed oil have been considered by some authorities as superior to the soya bean in some of the properties usually attributed to lecithin, it is soya bean lecithin which is chiefly used in the food and other industries.

LECITHIN is a constituent of the phosphatides (also known as lipoids or phospholipoids) or derivatives of glycero-phosphoric acids, and is usually associated not only with cephalin but also with the rather more complex derivative, sphingomyeline, of the same glycero-phosphoric group. Thus there are (according to origin and molecular structure) several varieties of lecithin, such as palmito-oleolecithin, palmito-arachidono-lecithin, stearo-oleolecithin, and distearo-lecithin. They also form compounds more or less stable with other constituents of animal or vegetable substances. In oilseeds they are combined with proteins or glucides.

The complicated structure of the phosphatides has formed the subject of a very considerable amount of research in this country and America, the work of Hilditch and co-workers at Liverpool University being particularly important and far-reaching.

Anti-oxidant Properties

The properties of the lecithins or associated groups forming the basis of a large number of patent applications are anti-oxidative or preservative and emulsifying, and these properties play an important part in many branches of the food industry.

Much work has been devoted to these anti-oxidant properties, and it is even yet not clearly established what is the precise constituent, *e.g.* of the soya bean or oil, that is mainly or wholly responsible for retarding or inhibiting oxidative rancidity when the appropriate soya product is added as a small percentage (0·1 per cent. to 0·5 per cent.) to lard, shortening, or other fatty material. The extracted meal or flour of the soya bean may sometimes be effective. Hilditch and colleagues expressed the view that the constituent was at all events a basic oxygenic compound rather than a nitrogenous compound. So far as the flour or meal is concerned it would seem that oat flour is superior to soya flour under some conditions as an anti-oxidant. But conflicting results have not been infrequent in the history of anti-oxidant research. In some cases it has been found that some of the constituents concerned may be pro-oxidative in the light and inert or anti-oxidative in the dark. Another result is that soya oil plus lecithin is much more effective than either alone, that the same applies to carbohydrates plus phosphatides, and further that synthetic products may be better than natural.

One patent claims that the presence of lecithin is immaterial, refined soya oil, deodorised at a temperature sufficient to destroy the lecithin, being claimed as an effective anti-oxidant. It is not clear that destruction of the lecithin was definitely proved.

Conservation of Vitamin A

An interesting and comparatively recent use of soya bean lecithin, in conjunction with hydroquinone, is that of conserving vitamin A in halibut and cod liver oils. It was found that hydroquinone alone was rather more active than commercial lecithin, but the two together were more effective than either alone. But this is not necessarily an anti-oxidative effect, for rancidity or oxidation would appear to be independent of vitamin A destruction. It is, in fact, another valuable application of lecithin which merits further investigation.

Research in Japan, *e.g.* by Nakamani, indicates that highly purified lecithin and cephalin in concentrations of 0·20 per cent. to 1·06 per cent. were either weak or ineffective when used with refined oils. In some cases, as with olive oil, higher concentrations might be effective but are generally undesirable. In the patents the limit specified is about 1 per cent. In view of the difficulty of identifying or isolating the actual anti-oxidant constituent the name *inhibitols* has been given to many substances found in the unsaponifiable fractions of vegetable oils, including soya bean oil, which, under varying conditions of purity, temperature, and other factors, might sometimes be anti- and at others pro-oxidative, or neither.

Commercially Prepared Phosphatides

Lecithin enters to the extent of about 30 per cent. to 35 per cent. in commercially prepared phosphatides, which are often called vegetable lecithin, much of the remainder consisting of cephalin. In addition to the phosphatides there is usually some soya bean or other oil (35 per cent. to 40 per cent. of the total preparation) and 4 per cent. to 6 per cent. moisture, also varying amounts of sterols, glycosides, and pigments. The commercial product is generally of a yellowish-brown colour, waxy consistency, solid at room temperature, soluble in

ether, petroleum ether, benzene, and fatty oils, partially soluble in alcohol, and practically insoluble in acetone and alkyl acetates. When freed of oil it rapidly undergoes oxidation on exposure to air, turns black, and becomes insoluble in alcohol and more soluble in water. It easily forms addition-compounds with metals, whereby the various lecithins and cephalins may be fractionated and purified. Also it is easily saponified by strong alkalies hydrolysed by strong acids. The phosphatides are highly hygroscopic, swell in water, forming colloidal solutions, and effectively lower the surface tension of aqueous solution. They are excellent emulsifying agents, and to this owe most of their industrial applications.

These are many and varied—as food modifiers, in cosmetics and pharmaceuticals, textiles, leather goods, plastics, soaps and detergents, special emulsifiers, and petroleum products.

Tests with Frozen Pastry

In the food industries both soya flour and oil, or rather the high-fat flour (with 20 per cent. oil content), is used partly for its anti-oxidative properties due to phosphatide content. For example, Andrea Overman, in *Food Research*, 1947, **12**, 365-371, describes results of tests with frozen pastry containing 0, 5, 10, 15, and 20 per cent. full fat de-bittered soya flour, and with pies (apple and custard) containing 0 per cent. and 20 per cent. soya flour. Three series of each type pastry and pie were prepared: (*a*) baked prior to freezing, (*b*) stored raw, and (*c*) stored raw and baked after removal from refrigerator, the temperature of this being 0° F.

Peroxide numbers (rancidity) were determined on fat extracted from pastry containing the different percentages of soya flour. Free fatty acids and peroxide numbers were determined on fat extracted from crusts of pies held in frozen storage for twelve months. Free fatty acids were low, and in all cases, under the conditions of these experiments, peroxide formation was inhibited in the fat of pastry containing soya flour, though the actual percentage content of this appeared to matter little. Nor was there much to choose between pastry stored raw or baked prior to freezing. The soya flour addition also favourably affected the tenderness and flavour of the pastry and its browning when baked.

The author considers that the constituents of soya flour, acting as fat anti-oxidants, are probably cephalin and tocopherols and other substances, and the stabilising effect of commercial soya bean lecithin is most likely due to its cephalin content. (See also work by Olcott and Mattill, 1946, on lecithin as anti-oxidant.) He states further that both tocopherol and soya bean lecithin have been shown to act as anti-oxidants for lard, and when both are used together considerably enhanced effect is noted. Reference also may here be made to C. L. Bibby (FOOD MANUFACTURE, 1945, **20**, 441-443) on the anti-oxidant properties of vegetable phosphatides, where the view is expressed that the cephalin present with soya bean lecithin acts as synergist with tocopherol. See also H. A. Mattill, on "Anti-oxidant Synergists" (*Oil and Soap*, 1945, **22**, 1-3). The addition of lecithin in the manufacture of macaroni, by incorporating a certain amount of soya flour in the premix, has been described by Winston and Jacobs (*Food Industries*, 1947, **19**, 166 and 327), and considerable improvement claimed.

Lecithin is largely used in the margarine, shortening, and allied industries. With margarines made chiefly from coconut and palm oils, phosphatide additions of 0·1 per cent. to 0·3 per cent. reduce spattering and other troubles. This reduction of spattering or "margarine effect" is regarded as a quantitative test of phosphatide efficiency. Originally yolk of egg (0·1 per cent. to 0·2 per cent.) was added to the margarine mixture to ensure complete emulsification, to give a closer resemblance to butter, but now lecithin has almost entirely replaced it.

Advantages of Lecithin

Other advantages of lecithin claimed in the patents or literature are better moisture and salt retention during storage, more effective incorporation of condensed or dried milk, and what is of definitely great importance a convenient method of stabilising and incorporating vitamin concentrates. The particular type or form of lecithin used is not immaterial. In Bollmann's earlier process, for example, soya bean lecithin, together with 30 per cent. to 35 per cent. oil, was said to be particularly active. Many years ago, in German Pat. No. 474,269, it had been proposed to mix with the phosphatides from a third to a half of their weight of vegetable oil, such as that of the coconut, for use in margarine manufacture. Somewhat later, in German Pat. No. 585,972, halogenated phosphatides had been recommended as substitutes for egg yolk; but here one may enquire with Frydlender, in his recent review of lecithin uses (*La Rev. des Prod. Chim.*, 1947, **49**, 145-150): What precisely would be the physiological effect of such halogenated phosphatides in margarine?

Lecithin in the Chocolate Industry

In chocolate and allied manufactures it is probable that the effect of small additions of lecithin is still more remarkable. Certainly some substantial claims have been made in the patent literature since Lefevre-Lebeau first suggested it in 1934 (*Bull. Off. Office Internat. des Fabricants de chocolats et cacao*, 1934, **4**, 333). An addition of 0·2 per cent. to 0·3 per cent. lecithin ensures a much more uniform or homogeneous mixture and a perfectly smooth product. Also it permits a reduction in the amount of cocoa butter or other hard fat required, and improves the keeping qualities of the chocolate. But

the limits of lecithin addition must be strictly observed and not exceed 0·3 per cent. This, be it noted, is not pure lecithin, but the crude product or complex mixture of phosphatides and other substances forming the residue rich in lecithins in defatting suitable material. This amount is quite sufficient to reduce materially the viscosity of the sugar/cocoa butter mixture and secure the other advantages claimed. Lowered viscosity is doubtless due to the action of lecithin in reducing surface tension, as pointed out by Avent and Morgan (*J. Soc. Chem. Ind.*, 1932, **51**, 169-171). Lecithin is further said to reduce or inhibit formation of frosting or white deposit on stored chocolate, due to crystallisation of the cocoa butter. If it is desired to improve the flavour of the lecithin itself this may be done, according to B.P. 452,683, by mixing it with sugar, lactic bacteria to promote fermentation, or in other ways. Further information on the use of lecithin in chocolate or other cacao products is given, *e.g.* by Bornmann (*J. Assoc. Offic. Agric. Chem.*, 1942, **25**, 717-718).

Bakery Goods

In baking and confectionery the addition of lecithin (0·2 per cent. to 0·3 per cent.) to the flour mixture or dough, for example with the yeast or very soon thereafter, in the form of lecithinated flour such as soya flour, or as an aqueous solution or suspension, improves keeping qualities, texture, with greater uniformity or homogeneity. If fatty material is to be incorporated in foods such as bakery goods and biscuits, addition of lecithin not only tends to conserve the fat, *e.g.* against oxidation or rancidity, but, owing to its colloidal nature, it also promotes better mixing and homogeneity. A trace of lecithin, say 0·05 per cent., is said to have a rather remarkable effect in browning fats and so improving the colour and appearance of the food products containing them when baked or fried.

For use in bakery goods it is further suggested, in German Pat. No. 708,805, that the lecithin be dissolved in lactic acid of 90 per cent. strength. This solution when diluted forms an emulsion for incorporating in the dough or paste. Another mode or vehicle of use is suggested in U.S. Pat. No. 2,334,401, namely admixture with sugar or salt, forming a mixture which is thoroughly ground.

Lecithin is used also in caramels and other confections, in cheese manufacture (German Pat. No. 697,440), for fixing flavours and aromas generally, and in other ways. Only a few of the numerous patents and claims have been mentioned above by way of example, but these will doubtless suffice to illustrate the wide range of use and versatility of this remarkable product in the food industries.

Intensive research continues in this country, the U.S.A., and elsewhere with a view to clearing up many questions not yet definitely determined, and to extending still further the many industrial uses of lecithin and its associates.

French Milling Congress

THE forty-fourth Congress of the A.N.M.F. (*Assocn. Nat. de la Meunerie Française*) was held in Paris early in the year and was attended by more than 1,700 millers from all parts of France. The President, M. Lucien Brisson, thought that the attendance of about a third of the total membership was very creditable under the circumstances. Among the distinguished visitors were the Minister of Agriculture (M. Pflimlin), the Under-Secretary of State (M. Coude du Foresto), the President of the International Milling Association (M. Vuylsteke), and M. Monnet, well known in connexion with France's Ten-year Plan.

M. Pflimlin referred to some of the difficulties of the French milling industry, especially the lack of sufficient grain to keep the mills running to capacity. Despite the great value of imports, and especially the help from America, it is to French soil that one must look for salvation. The farmers have largely increased their sowings, and one could look forward to the next harvest with some cautious optimism; but much remains to be done, particularly in the direction of establishing the "wheat policy" on a firm basis. Here he acknowledged that one of the chief factors would be the fair price. Another would be the fostering of international co-operation, in which field there was great work for the A.I.M. (*Assocn. Internat. de la Meunerie*), whose President from Belgium was welcomed.

Several papers of technical and economic interest were read. One outlining the activities and policy of the French Millers' Association described how income was now more than 12,000,000 francs, and how the schools of milling and research laboratories had resumed full activity. Proposals to nationalise these, *e.g.* by the *Office des Cereales*, had so far been defeated. During the past two years special courses for rapid instruction and training of higher grade workers and engineers had been established. These are limited at present to Paris, but it is hoped to establish provincial centres very soon.

Other subjects included electric supply under the new nationalisation scheme, the value and importance of the small man in the milling industry, and quality control of cereals and flours. This last, by Jean Buré, Director of the Laboratories of the French School of Milling, stressed the importance of the conditions of high extraction, moisture content and control, density, panification tests, and flour analysis.

TO AUTHORS

FOOD MANUFACTURE is prepared to consider the publication of any books on scientific and technical subjects which authors might care to submit.

Food Plant Hygiene

The Annual Congress of the Royal Sanitary Institute was held at Harrogate in May, during which a joint meeting with the Food Group of the Society of Chemical Industry discussed the cleaning and sterilising of plant in the food industry. After an introduction by Dr. E. B. Hughes, chairman of the Food Group, who described the work of the Food Group, papers were presented by Dr. J. G. Davis on "The cleaning and sterilising of dairy and ice cream plant," by Mr. H. J. Bunker on "The hygiene of beer production and consumption," and by Mr. D. H. F. Clayson and Mr. C. W. Chater on "The cleaning and sterilisation of plant and utensils in the food industry."

CLEANING was described by Dr. Davis as the removal of dirt and all residues, particularly those which serve as a food for bacteria. Sterilisation is only a finishing process, cleaning being the more important operation. Unless all food residues are removed, the few remaining bacteria can proliferate rapidly in the presence of food, moisture, and warmth. A reasonable standard for commercial sterility or "sanitisation" is one colony per ml. capacity or per square centimetre of surface.

Fundamental Principles

Although different methods can be used successfully, all methods conform to certain fundamental principles, which were enumerated as follows:

(1) *Cleaning and sterilising must always be regarded as distinct and different operations.*

(2) *The first treatment should always be a cool or tepid water rinse.* Cold water hardens the fat and hot water denatures the water-soluble proteins which, with calcium salts, form a strongly adhering film. Hard water should be softened.

(3) *The second treatment should be with a suitable detergent solution applied as hot as possible.* This emulsifies the fat and proteins, partially saponifying or hydrolysing them, and finally washing away the broken down and loosened milk constituents. The rinsing is completed by hot water. The emulsifying power of the detergent solution is related to the surface tension and its ability to penetrate between dried-on milk film and the metal surface.

(4) *Should any milkstone be visible after the detergent treatment, this must be removed by a weak acid solution*, otherwise the sterilising will not be efficient.

(5) *"Scale" or "fur" resulting from the use of hard water is inimical to sterilising*, and can be particularly troublesome in bottle-washing machines. As with milkstone, dilute acid treatment is necessary for its removal.

(6) *Special precautions must be observed with certain metals, particularly aluminium and tin.* Detergents for use with aluminium and tin should contain at least 25 per cent. silicate, and preferably no caustic soda at all. The incorporation of about 10 per cent. of sodium sulphite has been recommended to prevent corrosion of tinned plate, but this is only rarely used in this country. All metals, including stainless steel ("crevice attack"), can suffer corrosion with chlorine, especially if used with soft water which has a low *p*H.

(7) *After cleaning, equipment should be left either dry or in contact with the sterilising solution.* The better method is to keep thoroughly clean plant in a dry condition as bacteria cannot grow without moisture.

Churns are generally treated by pre-rinse, hot rinse or hot detergent, steam, and sometimes hot air at 240° F. For containers which have to be emptied and cleaned quickly; a chlorine wash is better than steam for sterilising.

On the Continent plant is treated with dilute nitric acid, detergent, and final rinse, and only rarely taken down, but this method has not been generally adopted in this country. Pasteurising plant should be dismantled at least once every day and thoroughly cleaned and sterilised. The modern High-Temperature-Short-Time pasteurising plant is not susceptible to thermophilic growth as is the Holder plant.

Problems in the Dairy Industry

Only a very small proportion of bottles is now scalded with steam or hot water. Most big dairies employ bottle-washing machines using hot detergent at 140° F., which both cleans and sterilises the bottles. It is important, however, to maintain rinse solutions in a satisfactory bacteriological condition.

In dealing with some special aspects of problems in the dairy industry, the lecturer emphasised the significance of the individuality of utensils, and the effect of atmospheric temperature on the bacteriological condition of utensils and plant, the importance of the interval between sterilising and use, and further pointed out that the larger the container the smaller is the relative contamination by a given number of bacteria per unit of surface.

Hypochlorite solution used for sterilising is some-

times used at an unnecessarily high strength, about 150 p.p.m. at a minimum temperature of 120° F. for a minimum time of two and a half minutes being recommended. Too strong a chlorine solution might lead to serious corrosion, especially when the water is soft.

Hygiene in the Brewery

Mr. Bunker, in dealing with the hygiene of beer production and consumption, briefly described stages in the making of beer.

On account of its high acidity beer is one of the safest of foods from the bacteriological point of view. The *p*H of beer is usually about 4, and this probably explains why pathogenic bacteria are always absent. In addition, hops and alcohol are factors inhibitory to bacteria. The prolonged boiling of the wort gives complete sterility at one stage, and the lecturer was of the opinion that the maintenance of clean mains was the most important item of hygiene in the brewery. The cleaning of these mains is a regular operation, for which caustic soda solution is commonly used.

A point of some importance in the cleaning of brewery plant (which might consist of copper, wood, slate, aluminium, stainless steel, or waxed-lined materials), is the fact that in course of time a deposit known as "beerstone" forms on the side of the fermenting vessel. The modern brewer usually removes this beerstone, thus eliminating what would otherwise become a dangerous lurking place for micro-organisms.

Bottles and bottle-filling machines require particular attention. For bottle washing, caustic soda is the chief constituent of the detergent, and the general standard of cleanliness in these machines is now very high.

Preservatives are not added to bottled beers, the old idea that the brewer adds chemicals to beer being entirely erroneous. The only preservative which is permitted in brewing is sulphur dioxide.

Chief Sources of Contamination

One of the chief sources of contamination in breweries is old cellar floors which, when they become cracked, are difficult to clean. Such floors can be treated with chloride of lime or antiformin (sodium hydrochlorite and sodium hydroxide). Phenolic antiseptic should not be used, for obvious reasons.

The lecturer next dealt with the very important aspect of hygiene in beer-houses, and named three methods for dealing with the problem of glass washing:

(i) the automatic glass washing machine,
(ii) the self-emptying sink,
(iii) the addition of some suitable detergent or antiseptic to the rinse water.

The author expressed a preference for the third method, and described recent work on the use of quaternary ammonium compounds for this purpose.

Dealing finally with the question of drying cloths, the author said that most bar-tenders prefer to dry and polish glasses after rinsing. If the cloths are allowed to get dirty they may well put back on the glasses more organisms than were there before drying. It is essential that any cloths used should be in a good bacteriological condition.

Cleaning of Restaurant Utensils

Mr. Clayson and Mr. Chater, in dealing with the present-day communal feeding in restaurants and canteens, stated that the effects of inadequate hygiene in the kitchen may be serious. Although machine washing is growing in restaurant kitchens this method is not fool-proof, and in the lecturers' experience there is not much difference between the results of hand-washing and machine-washing.

They pointed out that dirt is not defined from the legal point of view, and that it is necessary, in order to comply with the Food and Drugs Act (1938), to define processes that can be relied upon to destroy or remove pathogenic organisms if they should be present. This definition would have to be in chemical or physical terms in relation to detergent concentrations, temperatures, times, etc. With highly glazed or polished articles the appearance is a very good guide to their hygienic condition. This question is important because the removal of soiling deposits from food utensils is an important stage in securing a satisfactory hygienic condition.

Instead of stating that a certain organism is destroyed in a certain time at a certain temperature, it is preferable to refer to destruction rates, *e.g.* the decimal reduction time (D.R.T.), which is the time required to reduce the count to one-tenth of what it was originally. The D.R.T. of most intestinal organisms is of the order of one minute at 140° F. to 145° F. At 160° F. or over the D.R.T. values of staphylococci and streptococci are a matter of seconds only.

Thermoduric organisms are of little sanitary significance. "Sanitisation" may therefore be defined as a treatment which eliminates pathogenic and food poisoning micro-organisms, but which may not destroy thermoduric organisms.

American Standards

The United States Public Health Service Code requires:

(1) A cleaning process with a detergent solution at 110° to 120° F.
(2) Sterilisation, with a choice of four methods.
(3) Drying with clean cloths, or preferably by evaporation.

The standards required in America give, apparently, a very wide margin of safety if the conditions for High-Temperature-Short-Time pasteurisation, *i.e.* 162° F. for not less than fifteen seconds, can be taken as a guide for the destruction of pathogenic

organisms. Evaporation after hot water rinsing is preferable to drying by a cloth.

A plant used for the preparation, service, and storage of food needs the same, if not more, attention from the hygienic standpoint as the multi-service utensils.

To obtain a bacteriological effect with steam it is essential to keep the steam in an enclosed space with a comparatively small vent, and to continue steaming for at least three minutes after steam issues from the vent at over 205° F.

Hypochlorite treatment must be followed by further rinsing with cold water.

Water Pollution

An account of the work done by the Water Pollution Research Board on the treatment of water, sewage, and industrial wastes, and on the effects of polluting substances on surface waters, is the subject of a recent publication.* References are included to papers published during the year in scientific journals in which some of the investigations are described in more detail.

For many years the Ministry of Agriculture and Fisheries has operated cleansing stations at which mussels from polluted waters are cleansed of bacteria before being released for sale. Sea water is pumped to the cleansing station and treated with chlorine to sterilise it; the mussels are then immersed in it for about sixteen to twenty hours. During this time they excrete a compact mass of faeces and pseudo-faeces in which bacteria are embedded. It is found that after two treatments with sterilised sea water the mussels are free from pathogenic bacteria. This system of purification will only operate satisfactorily with sea water of sufficiently high salinity. In some estuaries where mussels are landed the water is not sufficiently saline, except during high spring tides. To overcome this difficulty a method of treatment has been developed in which sea water, after each cleansing operation, instead of being discharged to the sea, is treated with chlorine and then by aeration with diffused air; aeration removes excess chlorine and carbon dioxide, and replaces the dissolved oxygen which had been removed from solution in the water by respiration of the mussels in the cleansing tank. In semi-scale plant, twenty-six successive batches of mussels were cleansed satisfactorily in the same sea water. It is probable that this process will be adopted on a large scale on certain estuaries.

During recent years pollution from beet sugar factories has been greatly reduced by re-using process water from the diffusion batteries. Re-use, however, leads to increased corrosion in the batteries, and an attempt was made to control this by adding chlorine to the liquid with the object of inhibiting growth of bacteria which give rise to acidic substances. Although addition of large amounts of chlorine reduced corrosion in some parts of the plant, the method was not wholly successful. It has been maintained that re-use of process water has an adverse effect on the extraction of sugar from sugar beet. Comparative experiments with two semi-scale plants, however, gave no indication of such an effect, but in the plant in which liquor was re-used there was much more corrosion than in the other, thus agreeing with experience on a large scale.

Some further work is described on the effect of chlorination of sewage effluents. It had previously been found that effluents from some sewage-disposal works, although they did not contain directly poisonous substances, were rendered toxic to fish when chlorine was added in an amount smaller than the chlorine demand. This occurred when the sewage treated in the works contained spent gas liquor. It has now been shown that the toxic compound resulting from chlorination is cyanogen chloride, and that it is formed by the interaction of chlorine with thiocyanate, which was present initially in the gas liquor and which was not wholly destroyed during treatment of the sewage in a sewage-disposal works. In some circumstances chlorine may also react with phenolic substances to form chloro-phenols which are more toxic than the phenols themselves, but this does not usually occur when chlorine is added to sewage effluent, in which the concentration of phenolic substances is usually very low.

Monosodium Glutamate

The increasing use of monosodium glutamate to improve food flavour and palatability was discussed by M. J. Blish at the recent symposium on food quality and control held by the Division of Agriculture and Food Chemistry of the American Chemical Society in Chicago.

Glutamate has in the past been characterised as having a "meatlike flavour." This characterisation, however, appears justified only when applied to glutamate preparations which contain significant amounts of "impurities" having distinct odours and flavours of their own. Pure monosodium glutamate, like common salt, has a distinct taste but no odour.

Many foods, especially soups, cooked meats, fish, and vegetable dishes, are improved in flavour and palatability by the addition of glutamate. Like salt, when glutamate is used properly, it improves acceptability without itself being perceptible to taste. The important result is not in any flavour contributed by the glutamate, but rather by its ability to accentuate the characteristic flavours initially present in the food.

* *Report of the Water Pollution Research Board.* D.S.I.R. Pp. 39+iv. H.M.S.O. Price 1s. net.

Fruit Juice Congress

ATTENDED by the Ministers of Public Health and Agriculture, and fifty-four delegates from twenty-three countries, as well as 200 French representatives, the First International Congress of Fruit Juice Manufacturers was held in Paris last April. Four meetings were held, in the course of which an International Federation of Fruit Juice Producers was created.

Among the papers read was that of Professor Boulet, who spoke of the food, therapeutic, and medical value of fruit juice. Since doctors have already recognised its value, it was hoped that legislation protecting and controlling it in the various countries would be passed.

The report concerning such legislation was presented by Monsieur Guex, speaking for the Swiss delegation, and comprised an exact account of the laws in fourteen countries governing the production of fruit juice and the immense effort needed to co-ordinate legislation in order to give fruit juice a legal status in the world.

Professor Dalmasso, the Director of the Institute of Viticulture and Fruit Arboriculture of Turin University, pointed out that fruit juice was no enemy of wine, cider, aperitifs, or spirits.

The decision to create an International Federation of Fruit Juice Producers aims at the diffusion of medical information, harmonisation of world legislation, and improvement of production methods. It was agreed, however, that the influence of medical opinion and legislation would be of little avail if production methods could not reach the perfection desired by doctors and permanent control established. In this connexion, the report by Professor Chevalier of the National Agronomical Institute had particular interest. He gathered together the reports of fourteen nations, showing that doctors can order fruit juices with the greatest confidence and assurance that rigorous conditions are complied with.

Matters decided in the course of the Congress were as follows:

1. Considering the importance of harmonising legislation in the different countries, that exchanges of documentation should take place and concerted action be taken on an international level to secure the best quality products.

2. Having considered different techniques of preparation of fruit juices, that studies should be made in order to maintain the maximum natural quality of fruit juices by using suitable processes, and that laboratories should have the means and conditions necessary to work to this end.

3. Following the report concerning propaganda for fruit juices, that this should be rationally organised and issued under a collective form by an organisation of producers, retailers, and consumers; that the State should support, both morally and materially, such efforts; that appeals should be made to writers, artists, instructors, hygienists, and particularly doctors, to emphasise different virtues of fruit juices; that a reduction in the price of fruit juices should be considered.

4. To implement the creation of a provisional bureau, with headquarters in Paris, aiming to study plans for Statutes of the International Federation; to establish connexions between all fruit juice producers; to plan an International Congress to ratify the creation of the Federation; to create exchanges of information on laws, methods of preparation, and propaganda between all associations and producers; to provoke the creation and development of Associations of Fruit Juice Producers; to assure diffusion of reports made to the First International Congress.

The Congress elected the Fruit Union (Switzerland), to the Presidency, and Monsieur Gerard d'Eaubonne to the Secretariat-General of the provisional bureau. In addition, it was decided that all countries should notify the name of the person chosen as representative on the provisional bureau as soon as possible.

Irish Bakery Industry

THE post-war period, which was expected to bring more settled conditions, has, if anything, increased the difficulties facing the Irish bakery industry.

As Eire's supplies of wheat since the beginning of the war were dependent on the International Allocation Body, it was impossible for bakers to obtain the required quantity of imported wheat, particularly of North American hard winter grain.

In January, 1947, bread rationing was introduced, and it caused considerable hardship to flour confectionery manufacturers for some months until consumers had estimated how far their coupons would go. Manufacturers were further relieved when additional coupons applicable to flour confectionery were issued. The present Irish ration is the highest in Europe, but it was never certain for how long it could be maintained at that level. In March this year, however, as a result of representation at the International Wheat Conference, Eire was allocated 360,000 tons of American grain and anxiety in the industry was relieved.

To eliminate waste Irish bakers have been forbidden to sell bread that has been less than twenty-four hours baked, and the dusting of rolls or bread with flour has also been discontinued.

Early last year the extraction rate was reduced from 90 per cent. to 85 per cent., but bread and flour still varied considerably in quality for some time because of the different strengths and qualities of imported wheat and the varying colours of flour imported to maintain the stipulated ration.

Controlled selling prices of batch and fancy bread and flour remained unchanged in Eire until November 3, 1947, when the price of batch bread was reduced by ½d. per 2 lb. loaf and fancy bread by ¾d. per 2 lb. loaf and ½d. per 1 lb. loaf. The Government fixed price for flour was reduced by 19s. 3d. per 280 lb. At the same time subsidies on bread production ceased, involving batch bread bakers in heavy financial loss. Representations were made to the Government, but the measure of relief promised bakers is considered insufficient to meet the loss sustained by the November price changes.

News from the Industry

Forthcoming Events

The first Machine Tool Exhibition to be held in the United Kingdom since 1934 will take place at Olympia from August 26 to September 11. Organised by the Machine Tool Trades Association of Great Britain, the exhibition will be the largest of its kind ever held in this country.

E.V.A.'s Annual Luncheon

A review of the work of the Electric Vehicle Association of Great Britain was given by the Rt. Hon. Lord Citrine, P.C., K.B.E., chairman of the British Electricity Authority, at the Association's annual luncheon held in London on June 2. Speaking of the supremacy that electric vehicles had achieved in railway stations, factories, and the larger sphere of retail deliveries, Lord Citrine outlined their many advantages, but pointed out that such limitations as high capital cost, low speeds, and range should be investigated. For example, a higher speed was necessary if the electric vehicle were to compete with the petrol vehicle, and battery development had been slower than in any other phase of electrical progress. In this connexion Lord Citrine considered that the standardisation of batteries would be a great advance in the right direction. Although the British Electricity Authority was at the moment involved in the immediate problems of the industry, Lord Citrine assured the Association that a survey of transport facilities as a whole would be made in the near future.

Responses to Lord Citrine's speech were made by Mr. Peter Rochs, representing electric vehicle manufacturers, and Mr. R. Birt, B.Sc., M.I.E.E., A.M.Inst.C.E., F.C.I.S., representing electricity supply.

"Little Ships" Help Once More

A pair of 340 kW. alternators driven by two Paxman-Ricardo diesel engines taken out of landing craft have been installed at the Acton factory of T. Wall and Sons, Ltd.

S.C.I. Food Group

The following is a list of officers and committee members for the Session 1948-1949 elected at the seventeenth annual general meeting of the Food Group of the Society of Chemical Industry held on April 28 under the chairmanship of Dr. E. B. Hughes:

Officers:
Chairman: Dr. E. B. Hughes.
Vice-Chairman: Mr. T. Rendle.
Hon. Treasurer: Dr. J. R. Nicholls.
Hon. Editor Food Group Proceedings: Mr. T. Rendle.
Hon. Secretary: Mr. L. H. G. Barton.

Committee Members:

A. J. Amos.	J. G. Davis.
A. L. Bacharach.	J. G. Huntley.
F. H. Banfield.	C. H. Lea.
J. H. Bushill.	E. M. Learmonth.
J. B. M. Coppock.	R. H. Morgan.
H. E. Cox.	S. M. Tritton.

Adhesives and Dextrines

Comprising liquid and cold water gums and glues, hot and cold water paste powders and other adhesives, the products of the Feculose Co. are made in an extensive range of qualities to suit the needs of any specialised industry. High grade soluble starches as well as dextrines from maize, farina, tapioca, and sago starches are also manufactured by the company.

Damp-proof Paint

Produced to contend with the problems of painting and decorating in food factories, a cement paint manufactured by the Adamite Co., Ltd., is non-toxic and dries with a stone-hard durable finish. It is unaffected by heat or damp and, if used externally, stops the penetration through walls of driving rain. The paint may be applied by brush or spray and is available in a wide range of colours.

Refrigerating Containers

A first consignment of "Frigmobiles," produced by Morrisons Engineering, Ltd., for the transport of perishable foodstuffs, has just been shipped to South America. These large refrigerating containers, built of light alloy, carry their own built-in refrigerating unit and are made in three standard sizes with capacity for loads from 2 to 5 tons. The equipment is available for temperatures ranging from 50° F. to 0° F.

Smaller metal containers for use with the refrigerators are also produced by the company in addition to insulated van bodies or trailers built to any specified size and made to maintain the required temperature conditions.

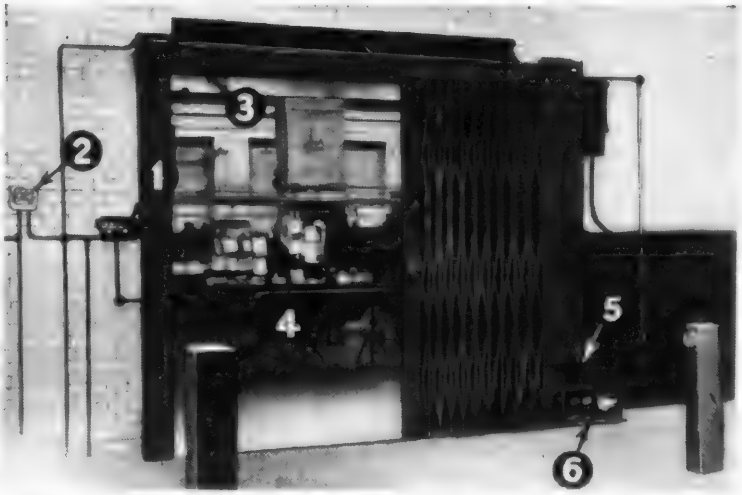
Plea for Packing Code

PROBLEMS OF THEFT AND PILFERAGE

Export packing as it affects insurance was the subject of Mr. E. H. N. Dowlen's paper read at the ninth members' meeting of the Institute of Packaging. Emphasising that theft and pilferage was the main problem, Mr. Dowlen gave a general picture of causes and possible remedies.

The Institute of London Underwriters, of which Mr. Dowlen is chairman, had recently drawn the attention of the Customs and Excise Department to the fact that liability of export commodities to theft and pilferage was increased by reason of the fact that in many instances packages were labelled in such a manner as to draw attention to their contents. It was requested that in the case of certain goods packages should be unlabelled. The Commissioners, however, would not accede to this request.

In the United States efforts were being made to establish a packing code or standards. Mr. Dowlen urged the introduction of some similar code in this country. If it were adopted no merchant could undercut another by means of inadequate packaging, the shipowner when he saw the hallmark on the container would know that the goods would be able to stand the strain of the voyage, and the underwriter would be able to quote the lowest possible rate for the venture.



Opening Gates by "Magic Eye"

A development of importance in the design of collapsible shutters and gates is the introduction of the ray-operated self-opening gate. Photo-electric cells placed at a convenient distance on opposite sides of the approach to a shutter gate are the "key" to its opening. A vehicle passing between these cells sets in motion the fully automatic opening mechanism of the gate and passes through; a predetermined time-switch closes the doors again.

The photograph shows the starter switch (1) actuated by photo-electric cells (4) and incorporating manual push button, stop, and start. Time relay switch (2) closing the gate after any predetermined period. Contact breaker (3) shutting off motor as gate closes. Photo-electric cell which actuates (6) through (1) and which can be built into a wall where convenient.

Manually operated clutch (5) for disengaging worm gear and motor, enabling the gate to be opened and closed easily by hand in the event of current failure. Driving motor and worm reduction gear ($\frac{1}{2}$ h.p.) (6).

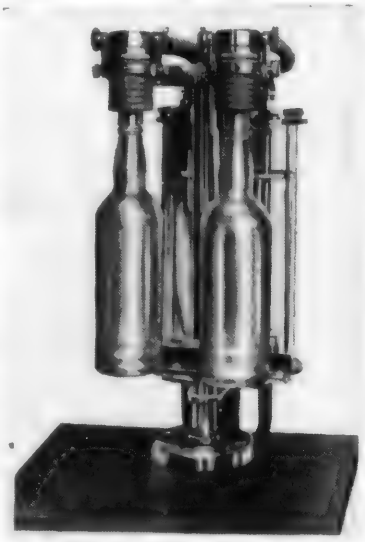
Pounds off Dumpers and Tractors

As from May 1, 1948, prices of the Muir-Hill 8 yard dumper (Models 10S and 10B) and of the shunting tractor (Model 100) manufactured by E. Boydell and Co., Ltd., were reduced by £15 and £10 respectively.

Cereal Products

Oat flakes, oatmeals, oat flours, barley flakes, pearl barley, and barley flours are some of the items produced at the Cumberland mills of John Pattinson and Son, Ltd., which are well situated for drawing from the finest English and Scotch grain.

Fillers for All Purposes



Liquid filling machines manufactured by Busby, Winter and Co., Ltd., are to change their name from "Ekem" to "Vacfill." The company's latest development, which is shortly being put into production, is a double-headed filling machine.

New Resin Improves Printing Inks

A new synthetic resin, developed specifically for use in printing inks, which is said to enable production of overprint varnishes of improved initial colour and reduced after yellowing, and to impart better colour in printing inks, is referred to in the March, 1948, issue of Patra's *Printing Abstracts*. Another development in printing ink is claimed to provide an ink of superior press stability, which remains open on the distributors and inking mechanism under high relative humidity and is capable of being set to non-set-off conditions by application of moisture after printing. Several other developments included in the abstracts also relate to improved and quicker drying inks.

Diesel-Alternator Plant

The May, 1948, grid failure, attributed by the British Electricity Authority to the present acute plant shortage and the heavy demands arising from the cold weather, serves as a reminder of the warning made some months ago by the Deputy Secretary of the Ministry of Fuel and Power, that the grid supply would not be fully able to meet electricity consumers' demand until 1951 or 1952.

Many industrial concerns have already given heed to this warning by installing diesel-alternator plant as a safeguard against stoppage of vital production, and also as a means both of achieving one third saving in demand on the national grid and reducing peak demand on which charges are based. This diesel-alternator plant has been largely manufactured and sold under the official scheme to aid bridging the gap between electricity supply and demand.

A large share in the implementation of this scheme was undertaken by Davey, Paxman and Co., Ltd., who announced that although a considerable percentage of the plant involved has now been allocated, interested concerns who feel the need for continuity of their power supply still have the opportunity of securing diesel-alternators under the official priority granted for delivery of plant of this type.

Time-Delay Switch

The time-delay switch, manufactured by Sunvic Controls, Ltd., is a small, glass-sealed, bimetallic relay, the bimetal being fitted with a small heater winding which, when energised, will close the contacts after a delay of 25 to 100 secs. The switch is evacuated, thereby eliminating any trouble due to oxidisation of the contacts, and the totally sealed construction completely excludes moisture, dust, and other foreign matter.

Swaging Machines

In the general sheet metal working shop the swaging machine is a tool in almost constant use as so many different operations can be performed on this machine with the necessary wheels. Swaging machines of various types manufactured by F. J. Edwards, Ltd., range from hand-operated machines for light work to heavy motor-driven machines to handle mild steel. One type is equipped with twelve pairs of wheels for swaging, wiring, jennying and closing operations and is supplied for direct hand operation to mount on a bench and for hand-geared drive mounted on a cast-iron stand. Machine bodies of good quality cast-iron are machined where necessary to take working parts and adequate provision is made for lubrication.

Mechanical Seals for the Food Industry

Consisting of a stationary seal ring of compounded carbon floating in the cover plate on a ring of synthetic rubber, a rotary seal ring of diecast iron or stainless steel floating on the shaft on another ring of synthetic rubber, a spring of stainless or carbon steel which maintains the seal faces in contact at a predetermined pressure and which, at the same time, positively drives the rotary seal ring, and finally a sleeve which transmits the drive from the shaft to the spring, the Flexibox mechanical seals for use with leading makes of food process pumps show, in comparison with conventional stuffing boxes, a greatly reduced tendency to become bacteria-infected and do not subject shafts to any wear.

The old labels for Daddie's Sauce are seen on the left against the newly designed labels on the bottles.

Industrial Lighting

Detailed information in connexion with industrial lighting fittings for Tungsten lamps has now been published by Phillips Electrical, Ltd. Concentrating, dispersive, and diffuser types are listed, and also an elliptical angle reflector for side and vertical surface illumination. All the fittings illustrated in the brochure are made from heavy gauge sheet metal, and, where applicable, made to British Standard Specifications.

Automatic Steam Raisers

Boilerhouses, fuel stores, and chimney stacks are not necessary with the electrode boiler. Manufactured by Bastian and Allan, Ltd., the boiler, which is completely automatic, can be placed beside the plant employing the steam, thus eliminating long pipe runs and steam losses.

Industrial Tapes with Slogans

New processes developed by Industrial Tapes, Ltd., enable small quantities of tape to be printed with a series of texts according to requirements, each roll thus forming a series of attractive labels. Other new developments include a glass fibre tape used for heat sealing of labels and an advertising tape which can be overprinted with a slogan measuring up to 20 in. by 2 in.

Tapes are available in cellulose, cloth, or paper in a wide range of colours and widths and being self-adhesive are easily and quickly applied.

Delivery without Obstruction

Lightweight bodywork is a feature of the Commer 3-4 ton van. One of the first vehicles to incorporate cast alloy side pillars and windscreen in the driver's cab, the van is fitted with interior racks running the full length on either side, enabling empty tins to be stowed away without obstructing delivery operations.

Commer 3-4 ton van with all-alloy bodywork and cab built by E. W. Campion and Sons, Ltd., as supplied for wholesale deliveries.

Ice Cream in Scotland

STRICT CONTROL AHEAD

Strict control in the making and selling of ice cream will come into force on November 1 when the new Ice Cream (Scotland) Regulations, 1948, take effect.

There are four main issues dealt with in the new regulations: 1. The registration of premises and vehicles used in the manufacture, storage, and sale of ice cream. 2. The construction and condition of apparatus, equipment, and utensils used. 3. The cleanliness of the staff engaged in the work. 4. The heat treatment of the ingredients of ice cream.

On November 1, 1948, onwards it will be unlawful to make, store, or sell ice cream except in premises which have been registered by the local authority. Vehicles used for the sale of ice cream will also require to be registered. Boarding houses, clubs, hotels, and inns are exempt, as are restaurants where ice cream is sold only as part of a meal. If ice cream is not manufactured on the premises of theatres, cinemas, concert halls, and similar places, they are also exempt. Registration is not required for shops where ice cream is sold in closed wrappers as received from manufacturers.

To effect registration the local authority must be satisfied that the premises and vehicles are generally suitable, and that they are not otherwise used for any unsuitable purpose. The local authority must also be satisfied that the applicant is a suitable person to engage in the making and selling of ice cream, but appeal to the Sheriff may be made against a refusal to grant registration.

Equipment of all kinds also comes under the jurisdiction of the local authority, but any ice cream dealer aggrieved by their decision in this matter may appeal to the Secretary of State. The regulations also lay down conditions as to the cleanliness of the staff working with ice cream in factories or shops. This must be of a standard sufficient to prevent contamination of the ice cream or any of its ingredients. If any Medical Officer of Health has reason to believe that ice cream in any premises is associated with the occurrence of infectious disease, he can examine the persons employed there and prohibit any of them from continuing their work if he is satisfied that they are connected with the outbreak.

From November 1, except where ice cream is made from "cold mixes," the ingredients of all ice cream manufactured for sale must be heat treated.

While there is, at present, no bacteriological test reliable enough to be used as a statutory test, the Secretary of State feels that a bacteriological examination of ice cream is of value in indicating defects of manufacture or handling which call for investigation. He is advised that a bacterial count of more than 100,000 organisms per gram or the presence of coliform organisms in 1/100 part of a gram of ice cream may reasonably be taken as suggesting the possibility of fault in methods of making, keeping or distributing, and he therefore recommends local authorities to adopt these provisional standards.

New Packing Service

A comprehensive packing service, catering particularly for the packing of such foodstuffs as semolina and custard powder, has been put into operation by W. Page and Sons, Ltd. Modern filling machines have been installed and a wide range of packing materials are available. Aimed at assisting the small manufacturer, the service includes the receiving, packing, and despatching of the raw material, and advice will be given in the design and manufacture of skillets, bags, and other containers.

Industrial Containers

Liquid cans made from tinplate, composite canisters and drums with slip-lids, lever lids, and perforated or dimpled sprinkler tops, and confectionery and biscuit containers made from tinplate or aluminium are included in the wide range of industrial containers manufactured by Percenta, Ltd.

100 Employees = 2,261 Years' Service

In recognition of good service totalling 2,261 years shared by over 100 employees, Mac Fisheries gave a buffet dance in the Caxton Hall, Westminster, on May 3, when each employee was presented with a gold watch.

Mr. K. Bohemen Visits Canada

Mr. K. Bohemen, director of Polak and Schwarz (England), Ltd., will remain in Canada for some time on market research with a view to establishing the firm's own selling organisation, following his visit to the Canadian International Trade Fair, at which the company exhibited.

Dyestuffs Cheaper

It has been decided by Williams (Hounslow), Ltd., to make a special allowance of 2½ per cent. on present prices for all dyestuffs delivered on and after May 17. The company hopes that its customers will in turn pass this 2½ per cent. allowance on to their customers together with any additional contribution which they themselves can make in order that the final consumer may benefit to a considerable extent from the voluntary reduction of profits by the manufacturers.

Training for Management

The Institute of Economic Engineering have revised their syllabuses and examinations as a result of the Urwick Committee recommendations on "Training for Management."

The six specialist subjects selected to comprise the technical content of their examinations are:

1. Pre-production planning.
2. Production planning and control.
3. Methods, motion and time study.
4. Determination of manufacturing cost standards.
5. Performance and cost control.
6. Production incentives.

The common management subjects recommended in the Urwick Report were accepted as being suitable to meet the educational requirements on the managerial side of the Institute examinations.

Hodgsons Open New Recreation Ground

The official opening of the new 12-acre recreation ground for the employees of Richard Hodgson and Sons, Ltd., was marked by a visit from the Yorkshire County Cricket Club, who played a Beverley and District XI. The proceeds of the gate and donations amounting to £204 10s. 4d. were given to Frank Smailes' Benefit Fund.

Before the match a luncheon was given to the two teams by the company and attended by members of allied firms from London, Leeds, and York, the Mayor and Councillors of Beverley and representatives of firms and sports organisations in the district.

Boxfoldia Conference

In opening the fifteenth annual conference of Boxfoldia, Ltd., held at St. Hugh's College, Oxford, from April 9 to 11, Miss Beryl Foyle, joint managing director, spoke of the first residential conference in 1928. An integral part of the company's existence and development, the 1948 conference had as its subject "The Social Significance of Industry."

Speakers at the conference included Mr. Harold E. Clay, formerly assistant general secretary of the Transport and General Workers' Union and recently appointed a member of the Road Transport Executive, Sir Hugh Chance, M.A., F.I.I.A., C.C., chairman of Chance Brothers, Ltd., and Mr. Lewis Ord, author of *Secrets of Industry*.

I.C.I. Reduces Prices

In view of the Government's request that prices should not only be stabilised but reduced, the Board of I.C.I. has decided to reduce prices over a wide range of its products. In some instances, this voluntary reduction will be expressed in the shape of specific price decreases; in others, it will take the form of a special percentage reduction covering certain ranges of goods.

The Board is endeavouring to stabilize prices as far as possible, but heavy increases in the costs of raw materials or services may compel alterations.

At the opening of Hodgsons' recreation ground. Len Hutton (left) and R. Halliday go in to bat. Factory chimney smoking in background.

Eastern Growers' Centre

A fruit growers' centre is to be established at Ipswich, Suffolk, under the organisation of the Eastern Growers' Marketing Association, Ltd., to ensure better distribution of tomatoes and other produce.

I.P.C.A. Appoint Officers

The following officers and executive committee will serve the Industrial Pest Control Association for the year 1948:

President: Mr. G. McLaren (Haller Laboratories, Ltd.).
Vice-President: Dr. F. P. Coyne (Imperial Chemical Industries, Ltd.).
Hon. Treasurer: Mr. C. Stuart Kregor (W. Edmonds and Co., Ltd.).
Hon. Auditors: Mr. T. A. Acton (Pesticidal Services [Ireland], Ltd.); Dr. D. R. Leitch (Ratsouris, Ltd.).

Executive Committee:
Mr. R. G. Berchem (Jeyes' Sanitary Compounds Co., Ltd.).
Mr. J. W. Hedgcock (Chelsea Insecticides, Ltd.).
Mr. W. Hivey (Hivey Fumigation Co., Ltd.).
Mr. R. P. Merritt (Stafford Allen and Sons, Ltd.).
Mr. J. B. Wilton (Fumigation Services, Ltd.).
Mr. Angus F. McIntosh (*ex officio*) (Thomas Harley, Ltd.).
Joint Secretaries: Mr. Allan J. Holden, Mr. W. A. Williams.

The Institute of Physics

Dr. F. C. Toy, Director of Research, The British Cotton Industry Research Association, was elected as the new President of the Institute of Physics at its annual general meeting on May 20, 1948. Dr. T. E. Allibone was elected Vice-President. The Honorary Treasurer, Mr. E. R. Davies, and Honorary Secretary, Dr. B. P. Dudding, were elected. Mr. J. H. Awbery and Mr. E. W. H. Selwyn were elected as Ordinary Members of the Board, and Dr. G. B. B. M. Sutherland was appointed by the Faraday Society as its new representative on the Board.

The Report for 1947 of the Institute of Physics mentions among the new publications in hand a book of *Laboratory and Workshop Notes*, the Report of a Conference on The Measurement of Stress and Strain and a second edition of the *Handbook of Industrial Radiology*. The Australian branch has in preparation a report on Physics in Australia and a booklet on *Physics as a Career*.

Drivers must still Keep Records

The Traders' Road Transport Association draws attention to the fact that the law requiring drivers of goods vehicles to keep records has never been suspended and is still in operation.

Booklets Received

The policy of the British Baking Industries Research Association is to provide members with the means of obtaining the latest scientific and practical information related to the many problems connected with the production of baked goods, and their method of fulfilling this aim is described in an illustrated membership handbook. Members are entitled to the services of an analytical laboratory and test bakery and, towards the end of the year, a bacteriological laboratory will also be available. In addition to an information service, monthly abstracts, bulletins, and reports of the Association bring to members the most recent scientific news and general information about baking.

*

A handbook describing their products has been produced by British Industrial Solvents, Ltd., and contains an alphabetical list of organic chemicals and general information regarding uses, methods of testing, properties, and, where available, British Standard Specifications for comparison purposes. The booklet concludes with tables giving details of specific gravity, evaporation rate, and other data.

*

A report prepared by the Education Committee of the Institute of Physics puts forward their views on the developments which should take place in higher technological education and makes clear the basis of the Institute's dissent from the recently published report of the Parliamentary and Scientific Committee. The setting up of new technical colleges equipped with the necessary facilities to which branches of industry could look for advice and the advance of technological methods is advocated.

*

Produced by The Distillers Co., Ltd., a well-illustrated brochure describes the company's various yeast products, and covers such items as bakers' compressed yeast used in the production of bread and bakers' fermented smalls, dried bakers' yeast used for bread-making when compressed yeast is not available, and dried autolysed yeast containing a high percentage of protein.

OBITER DICTA

● That's the fishiest story I've heard since Dr. Summerskill said she liked snoek.—*Tommy Handley in Itma.*

● Food shortage and not the atom bomb is the biggest danger threatening the world today.—*Sir John Boyd Orr.*

● A hen is the only creature on earth that can sit still and produce dividends.—*America's National Butter and Cheese Journal.*

● I describe the week-end party in connexion with the Civil Service Selection Board as "a mad hatter's tea party."—*Lord Elton.*

● In Perth I can get buns bursting with currants. Down here I am lucky if I get one currant stuck on top of the bun.—*Bournemouth housewife.*

● When the importance of his task to the national economy is fully explained to him, the British working man knows how to put his back into his job.—*An official of Nuffield Exports, Ltd.*

● If I send you a pot of jam bought in a shop and covered with mould, will you either alter your opinion that jam is not deteriorating in the shops or eat the jam?—*Mr. Keeling, M.P., to Dr. E. Summerskill.*

● Unless we can make these barren plains of Africa produce, we have no right to be here. We have got to go through with the groundnuts and other schemes, or we are sunk.—*Mr. Strachey.*

● Schools should be allowed to change over to T.T. milk if they wish. What is the use of us producing all this T.T. if they have to put up with this pasteurised muck?—*Mr. W. H. E. Timms, reported in the "Bucks Advertiser."*

● May I suggest that you do one trip with me to the White Sea to instruct my crew in the art of stowing away fish? I suggest about February next. Please bring your winter woollies.—*A Grimsby trawler skipper to Dr. E. Summerskill.*

● If the Ministry of Food want to go on buying meat of poor quality they should definitely tell the people the reason for it, and not leave it to the private retail trader to "carry the can."—*Councillor E. S. Pascoe of Southampton.*

Company News

After payment of the dividends on the Preference and Cumulative Ordinary Share Capital, a dividend at the rate of 9 per cent. (less income tax) on the ordinary shares was recommended by the directors of the Home and Colonial Stores, Ltd.

*

At the fiftieth ordinary general meeting of Lipton, Ltd., held on May 29, it was proposed to pay a dividend at the rate of 12½ per cent., less income tax.

*

The forty-second annual report of the directors of Meadow Dairy Co., Ltd., recommends that after providing for the Preference dividends and a dividend of 12½ per cent., less income tax, on the Preferred Ordinary and Ordinary Shares, the amount to be carried forward would be increased by £3,580 in the subsidiaries and by £2,254 in the company's accounts.

*

That British industry would, before long, be permitted a reasonable opportunity of extension by the releasing to a much greater extent of supplies of steel and other materials together with a freer granting of building licences, was the hope expressed in the chairman's statement circulated at the fifty-first annual general meeting of W. J. Bush and Co., Ltd. It was only when this took place that the large amount of work successfully undertaken by the company's chemical and engineering research staffs could be translated into large-scale production.

Electrical Transformers for Export

Specialists in the design and construction of all types of transformers employed to change A.C. voltages from one value to another, The British Electric Transformer Co., Ltd., has this year completed half a century of service to suppliers and users of electrical power in this country and overseas. In 1932 the company became associated with Crompton Parkinson, Ltd., and today is working to capacity producing for export. Work is in progress on units up to 60,000 KVA and the development of designs for voltages above 200,000.

News from Overseas

Fishing Prospers in Denmark

Denmark's favourable situation close to good fishing grounds has been one of the prime conditions in the development of her fisheries into a leading export industry. While formerly fish was almost exclusively exported in a fresh state, either live or on ice, from about 1930 the export of filleted fish gained importance.

In recent years there has also been increased interest in the freezing of fish and fish products. It is not only in the filleting industry that freezing has been resorted to, but also in the exports of ordinary unsalted fish.

Actual processed fish products have become important in Danish fish exports only in recent years. Before the war very small quantities of smoked and salted fish were exported. During the war, however, there was an increase in the production of both salted herring and salted cod.

Although the processed goods are becoming an increasingly important part of Danish fish exports, the bulk of her exports continues to be fresh fish.

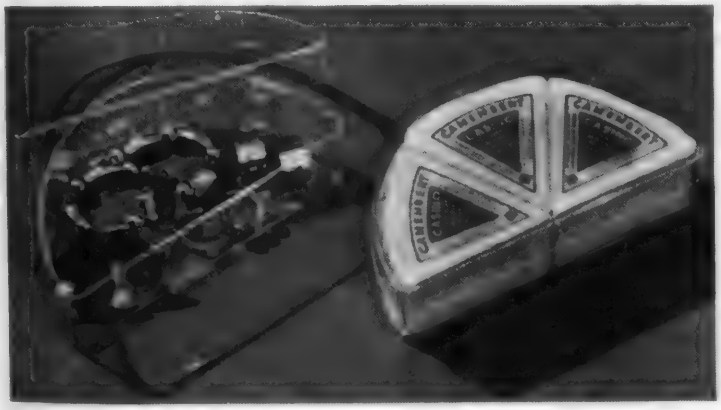
Modern herring smoking house in Denmark.

New Irish Project

Mr. J. J. Holloway, of Dublin, a native of Bansha, County Tipperary, is behind a project, which has financial backing from a number of residents, for the establishment in Bansha of an industry for the manufacture of edible products, including jelly and custard.

Parma Fair

By ministerial decree of March 11, 1948, it has been established that the industrial inventions to be shown at Parma's Canning Industry Fair from September 8 to 19, will receive temporary protection as laid down by the law of June 29, 1939.



Plastic Container for Cheese

A new, transparent, plastic container made of clear polystyrene, said to be the first instance of the commercial use of moulded plastic containers for any food product, has been produced by the Kraft Foods Company, Chicago.

A striking feature about the pack is its adaptability for use in the home after the cheese has been used. The decision to pack Kraft Camembert cheese in the plastic container was reached after it was shown that Camembert would cure perfectly in the new box.

Light in weight and of relatively low cost, the plastic container is free from taste or odour, resistant to acids, alkalis, and water, and the lid retains its perfect fit.

Australia's Whaling Industry

Despite hopes that after the war Australia would be able to revive her historic participation in the whaling industry of the Antarctic, the difficulty of obtaining suitable ships and equipment made serious delays inevitable. Effective action is, however, being taken to enable Australian whalers to operate from coastal bases, until more extensive operations are practicable.

A new company, Coastal Whaling Co., Ltd., has been registered to re-establish an old whaling station north of Carnarvon, on the coast of Western Australia. Negotiations are in progress with Norwegian companies for the purchase of whale-chasers. These will be manned with a combined crew of ten Norwegians and five Australians. More than 100 men have applied to work for the company. Many of them are Norwegians with previous experience at the whaling station near Point Cloates, 160 miles north of Carnarvon.

Canning Research Needed

INTERNATIONAL COMMITTEE'S PROPOSALS

More than thirty delegates from Western European countries, including six from England, attended the fourth post-war meeting of the *Comité Permanent International de la Conserve* held in Paris on the last two days of April.

The Secretary-General, M. Peissi, read the report of the previous meeting at Parma last autumn, and put forward some tentative proposals for simplifying the marking of canned foods and for reducing the numbers of can sizes.

The marking of cans was found to be carried out on principles common to most countries, and it was generally agreed that cans should show:

1. Name and address of the canner (or the distributor when of the same country).
2. Date of canning.
3. Net weight of contents.
4. Usual names of the principal products and ingredients.

It was agreed that embossing should be reduced to the minimum and that the country of origin could be coded by reducing the embossing to a small oval, carrying in it the initials, such as are used on cars in foreign countries, to show the country of registration. Thus "F" would indicate France, "G.B." would indicate Great Britain.

The sizes of containers are so numerous as to confuse the customer, and comparison of sizes in general use shows that a useful reduction of numbers could be made readily by adopting as standard a can with a capacity of 850 c.c.; this can would be indicated as a 1/1 size and other capacities would be indicated as fractions of this. The 425 c.c. capacity would therefore be 1/2, and a small percentage tolerance of variation would be allowed. The adoption of standard capacities would enable can-makers and canners to use their existing plant for stamping out and sealing cans because diameters (or end dimensions of square cans) need not be changed, only the height would have to be adjusted and this would not be difficult or expensive to do. There could, therefore, still be a wide range of shapes to suit various products, but uncertainty about can capacities would disappear. At the next meeting in November it is hoped to obtain the views of delegates when they have had the opportunity of discussing these proposals in their own countries.

The scientific aspects of canning were considered by a sub-committee under Dr. Henri Cheftel, of the Research Laboratories of J.J. Carnaud and Forges de Basse-Indre. The aim of this sub-committee is to ascertain in which direction there is the greatest need for research work on canned foods. At the next stage it might be possible to interest particular laboratories to cover these various aspects, and eventually it might be possible to arrange an international congress of scientists at which progress in research could be reported for the guidance of the industry. Among the subjects thought to be urgently needing research are: the bacteriology of canned foods which are deliberately not fully sterilised; the digestibility of canned foods; an alternative means of identifying cans other than by inking or embossing.

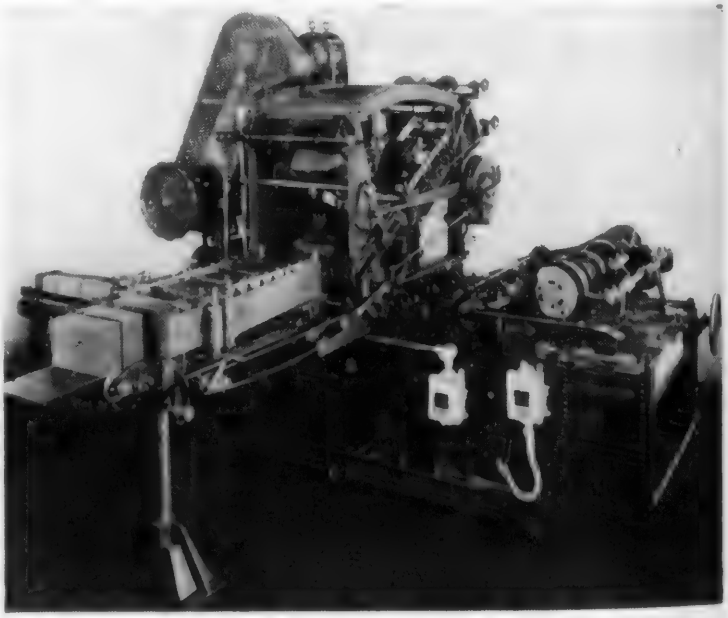
In addition the *Comité* voted funds to procure microfilm copies of national food regulations, as they apply to canned foods, so that its various members may be enabled to study documents in languages with which they are familiar, as a preliminary to publication of a complete survey.

Rice and Groundnut Schemes

The British rice mission to the Gold Coast have revealed that four suitable areas have been selected for extensive rice growing, subject to further examination, but they are confident that a considerable tonnage can be produced by using tractors.

One of the areas, Keta, 96 miles east of Accra on the coast, where a lagoon is to be reclaimed, could produce 50,000 tons a year. Other areas are Ketekrachi, 250 miles north-east of Accra, and Bamboi, about 200 miles north-west of Accra, both fed by the River Volta.

The secretary of rural development also disclosed that the groundnut scheme would cost £29,000,000, but that a pilot scheme, costing £1,000,000, would be started on two 10,000 acre farms.



Automatic wrapping machine, with an output of 60 packages per minute, for tight wrapping cartons of such products as cereals, crackers, and flour.

News from the Ministries

New Blight-Resistant Potato

A new type of potato highly resistant to late blight, bane of many potato-growers in the United States and other countries, has been developed under the national potato breeding programme of the U.S. Department of Agriculture.

Resulting from research started fifteen years ago, the new potato also resists certain virus diseases including net necrosis and mild mosaic.

While the new variety is already being increased by growers in Maine and New York State, and to some extent elsewhere, two or three years will be required to build up seed stocks sufficient for wide planting.

Grain Supplies Blamed for Fall in Poultry and Egg Production

World supplies of poultry and eggs are well below pre-war levels and full recovery will not be possible until grain supplies return to normal, according to a survey by the U.N. Food and Agriculture Organisation.

By mid-1947 chickens in Western and Central Europe numbered 75 per cent. of the pre-war average. Unfavourable 1947 harvests operated to postpone further advances at least until mid-1948. Progress in coming years will depend directly on the rapidity with which European grain supplies are restored.

A much more favourable situation exists in North America, according to FAO. Poultry numbers increased during the war period in the United States under the influence of high demand and large supplies of concentrated foodstuffs, and in Canada an even greater expansion took place.

In the United States the average number of chickens on farms in the years 1935-1938 was 405,100,000. On January 1, 1947, the figure was 475,400,000. This total had declined 1 per cent. by January 1, 1948. Some further decline by January 1, 1949, is probable because of the grain shortage.

The future pattern of trade in poultry and eggs will be determined by the success of the European Recovery Programme, and in particular by developments in the trading position of the United Kingdom, the largest importers.

Appointments

The Governing Body of the new Vegetable Research Station have selected for the post of director Dr. James Philp, B.Sc., Ph.D., F.L.S. The Ministry of Agriculture and Fisheries and the Agricultural Research Council have approved this appointment.

Dr. Philp will serve on the staff of the Ministry of Agriculture until the Governing Body is legally constituted and will at first be engaged on the search for a suitable site for the station, and thereafter will be concerned with its equipment and staffing.

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The Minister of Food, with the approval of the Prime Minister, has appointed Mr. A. E. Feavearyear, C.B., to be deputy secretary in his department in succession to Sir Herbert Broadley, K.B.E., whose release for service with the Food and Agriculture Organisation of the United Nations was announced recently.

Imported Meat

Following discussions with Port Medical Officers of Health and certain of the exporting countries the Minister of Health and the Minister of Food, acting jointly, have made regulations amending the Public Health (Imported Food) Regulations, 1937, to allow the importation of mutton and lamb carcasses from which a lymphatic gland has been removed. The amendment will bring the Regulations into line with present-day practice in exporting countries.

Table Jellies

The Table Jellies (Maximum Prices) Order, 1946, has been further amended by revoking the provision whereby the production of table jelly crystals in packets containing a minimum weight of 8 oz. was restricted to certain named manufacturers.

Manufacturers and traders are reminded that under the existing Labelling of Food Order all jellies must bear on their packets a statement of the net weight of the contents.

The new Order came into force on May 23, 1948.

Czechoslovakian Liqueurs

Authority has been given for the import of liqueurs from Czechoslovakia to the value of £10,000 f.o.b. (approximately 36,000 bottles) during 1948.

The Onions Order, 1948

A new Order, which will replace the Onions Order, 1946, as amended, will extend the period during which the lower ranges of maximum prices for onions will operate from June 26 to August 15, and it will omit the previous provisions relating to Ministry imported onions. Existing licences will be revalidated under the new Order.

Italian Imports

It has become necessary to introduce new arrangements for the payment of transport costs on fresh fruit and vegetables imported into the United Kingdom from Italy. These arrangements will operate in respect of all consignments of fresh fruit and vegetables passing the Italian frontier or leaving Italian sea or air ports after midnight May 21/22.

Importers will be required to give a new undertaking to the effect that all payments for freight and other charges, apart from certain payments to persons resident in this country will be transferred in sterling to Italian account only. The terms of the undertaking will also make importers responsible for ensuring that any forwarding agent employed will act in conformity with the new arrangements. Thus, forwarding agents who have hitherto been granted various foreign currencies to cover freight charges on Italian produce incurred in continental countries will now be able to make payment for these charges to Italian account only.

Copies of the form of undertaking will be sent to all importers to whom import licences have already been granted as well as to applicants for new licences. Copies may also be obtained from the Ministry of Food, Fresh Fruit and Vegetables Division, Import Section, Carlton Hotel, Pall Mall, London, S.W.1.

Mustard Contents Order

ORIGINAL STANDARD RESTORED

The Food Standards (Mustard) (No. 2) Order, 1944, has been further amended so as to restore to 0·35 per cent. the allyl isothiocyanate content of mustard which was temporarily reduced to 0·28 per cent. early last year. The new Order comes into operation:

(*a*) In respect of sales by the manufacturer on August 1, 1948.
(*b*) In respect of sales by wholesalers on November 1, 1948.
(*c*) In respect of sales by retailers on May 1, 1949.

The original standard for mustard was based on the assumption that a good quality mustard must contain certain proportions of white and brown mustard flour. It was undesirable to prescribe these proportions as a standard, since it is difficult to determine by analysis the proportions of each variety present in a given sample. Brown mustard flour was the ingredient in which the deficiency would be most likely to occur. The principle which gives brown mustard flour its characteristic flavour is a volatile oil called allyl isothiocyanate. As the quantity of allyl isothiocyanate in any given sample of mustard can be determined, this substance was selected as the basis of the standard.

Early in 1947 the shortage of home-produced supplies necessitated the import of brown mustard flour. Since the allyl isothiocyanate content of the imported variety is below that of the home-grown variety, it would not have been possible to maintain mustard production at the then existing level if the standard of 0·35 per cent. were retained. The Minister decided to lower the standard temporarily rather than reduce production.

Now that more English brown mustard flour is available, the original standard of 0·35 per cent. is being restored.

Edible Pulse

The Pulse (Control and Prices) Order, 1943, has been further amended so as to add Hungarian White Beans to the list of specified pulse described in Section (b) of Part 1 of the Third Schedule to the Order. The new Order came into force on March 28, 1948.

Imports of Rum

In order to ease pressure on storage in the British West Indies, authority has been given for the import into the United Kingdom from Jamaica, British Guiana, Trinidad, Barbados, and the Windward Islands, of rum distilled in 1946. This rum will not be ready for consumption until it is three years old and it must be stored in bond in this country until that time.

Any holders of stocks of this rum who wish to import should apply to the Wines and Spirits Branch, Ministry of Food, London Road, Stanmore, Middlesex.

Where the ownership has changed and the original supplier is acting on behalf of the present holder, application should be made by the former and not the latter.

Paper Price Increases

Maximum prices for the undermentioned types of paper, set out in the Paper (Prices) (Amendment No. 2) Order, 1948, and the extra charge allowed for sheets in the case of mechanical printings were increased from May 18. A maximum price is also fixed for imported insulation board ¾ in. thick; and the basis on which wallboard merchants' maximum prices are fixed has been revised:

(*a*) Mechanical printings.
(*b*) Wallpaper.
(*c*) M.G. sulphite papers, caps, and tissues.
(*d*) Pure Kraft and Sack Kraft.
(*e*) Cop tube paper.
(*f*) Pure Kraft liner and fluting.

Green Onions

Reports indicate that some growers and traders are doubtful whether the prices of green onions are still controlled. Growers and traders are accordingly reminded that the Green Onions Order, 1945, remains in operation and that the maximum prices prescribed in the Order still apply to sales of green onions at all stages of distribution.

Importation of Cherries

With the object of preventing the introduction of the Cherry Fruit Fly, the Minister of Agriculture and Fisheries has made an Order under the Destructive Insects and Pests Acts, 1877 to 1927, affecting the importation of cherries from European countries into England and Wales during 1948. The provisions of this Order are supplemental to any requirements of the Board of Trade and the Ministry of Food.

From May 19 the importation of cherries grown in Spain is prohibited; cherries grown in France, Italy, Germany, Austria, Bulgaria, Hungary, Switzerland, and Portugal will be admitted up to specified dates subject to certification as prescribed in the Order; while cherries from other European countries will be admitted after May 18 provided that they are accompanied by certificates of origin.

Fruit Imports

Arrangements have been made by the Ministry of Food, in agreement with the Board of Trade, for the importation under specific licence during the 1948 season of a limited quantity of grapes from Turkey, mandarins, tangarines, and clementines from Egypt (up to January 31, 1949), and bilberries from Finland.

Applications will be considered only from *bona fide* importers of fresh fruit and vegetables and they must be in respect of firm offers of business supported by evidence. They should be submitted in the first instance to the Ministry of Food, Fresh Fruit and Vegetables Division, Import Section, Carlton Hotel, Pall Mall, London, S.W.1.

Copies of the appropriate forms of application (Form ILD/A) may be obtained from the Board of Trade, Import Licensing Department, 189, Regent Street, London, W.1, from the usual Customs Officers or from the Ministry at the above address.

Applicants are reminded that under the Imported Deciduous Fruit Order, 1947 (S.R. & O. 1947 No. 2543), the price of imported grapes is controlled up to and including July 18, 1948, at certain stages of distribution.

Information and Advice

Ice Cream

B.2530. *Could you supply us with some recipes for the manufacture of ice cream, taking into consideration present-day conditions?* (Yorks.)

The following recipes were supplied as a basis for experiment:

		Per Cent.
1.	Sugar	11·00
	Fat	10·00
	Skimmed milk powder	5·00
	Soya flour	3·00
	Deglutenised flour	5·00
	Glyceryl monostearate	0·25
	Sodium alginate	0·25
	Total solids	34·50
	Water	65·50
		100·00

2.	Sugar	20 oz.
	Margarine	6 oz.
	Skimmed milk powder	6 oz.
	Wheat flour	8 oz.
	Soya flour	6 oz.
	Dried egg	4 oz.
	Glyceryl monostearate	¼ oz.
	Sodium alginate	½ oz.
	Water	6½ pints
3.	Full cream milk	6½ pints
	Evaporated milk	1 tin
	Margarine	13 oz.
	Sugar	20 oz.
	Skimmed milk powder	2 oz.
	Sodium alginate	½ oz.
	Flavour and colour	*q.s.*

Information Supplied

B.2400. *Formula for marshmallow cream.* (Bucks.)

B.2489. *Suppliers of apple peeling machinery and information on the storage of potatoes.* (Eire.)

B.2496. *Suppliers of a complete dough mixer.* (Kenya.)

B.2497. *Manufacturers of pea grading machinery.* (N. Ireland.)

B.2501. *Machinery for lecithin manufacture.* (Lancs.)

B.2503. *Names of manufacturers of appliances for heat-sealing Cellophane.* (London.)

B.2504. *Manufacturers of small thermometers for ascertaining the temperature of ice cream mix.* (London.)

B.2506. *Pickle and sauce manufacture.* (Lancs.)

B.2507. *Manufacturers of filters for lime juice, orange squash, and lemon squash.* (Kenya Colony.)

B.2508. *Suppliers of emulsifiers.* (Wilts.)

B.2509. *Literature on baking powder and suppliers of a sweetening material.* (Leics.)

B.2510. *Names and addresses of firms supplying machinery suitable for the manufacture and processing of fish and meat pastes.* (Warwicks.)

B.2511. *The manufacture of gelatine and literature on canning procedure.* (East Africa.)

B.2513. *Suppliers of lactose.* (Eire.)

B.2514. *Manufacturers of crinkled baking cups made of ornamental glassine paper.* (South Africa.)

B.2515. *Suppliers of plant for peeling and cutting oranges, lemons, sweet lemons, and grapefruit.* (Egypt.)

B.2516. *Suppliers of onions in brine, walnuts in brine, malt vinegar, brine salt, spices, and acetic acid vinegar.* (Dorset.)

B.2517. *Names and addresses of firms supplying vitamin D and ferrous ammonium citrate of a quality suitable for use in the preparation of foodstuffs.* (Glasgow.)

B.2518. *Manufacturers of machinery for closing and heat sealing the flaps of 1 lb. and 2 lb. cartons of dried fruit, and for wrapping the closed cartons with aluminium foil or Cellophane after the packets have been heat sealed and closed.* (London.)

B.2520. *Formula for a salad dressing without the inclusion of eggs.* (London.)

B.2521. *Cream filling using glyceryl monostearate.* (London.)

B.2522. *Suppliers of trucks for the haulage of sisal from plantation to factory.* (London.)

B.2524. *Recipe for ginger marmalade.* (Surrey.)

B.2538. *Custard powder recipes.* (California.)

B.2540. *Methods of marmalade manufacture.* (Egypt.)

B.2541. *Suppliers of equipment for scalding, blanching, and drying almonds.* (Belgium.)

B.2544. *Manufacturers of wrapping and cartoning machinery.* (London.)

B.2549. *Suppliers of propylene glycol.* (London.)

B.2550. *Names and addresses of suppliers of evaporators.* (London.)

B.2551. *Suppliers of snap-on closures for jam jars.* (London.)

B.2553. *Manufacturers of a small power or hand milk separator.* (Dorset.)

B.2554. *Suppliers of butter moulding and weighing machinery.* (Lanark.)

B.2555. *Manufacturers of an automatic can filling machine for meat products.* (Eire.)

B.2559. *Names and addresses of firms who could advise on fluorescent lighting for factories.* (Yorks.)

B.2563. *Suppliers of pea viners.* (Norway.)

B.2566. *Manufacturers of electric potato crisping machines.* (Lancs.)

Information Required

B.2534. *Contact with live biscuit manufacturing firm desiring progressive distribution or manufacturing unit in India.* (India.)

Recent Patents

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents," and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Specifications Published

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

597,207. FOWLER, S., and BENFIELD, P. J.: Process and preservative solution for the preservation of eggs.
597,235. ATLANTIC COAST FISHERIES CO.: Fish filleting machines.
597,245. ROSE BROS. (GAINSBOROUGH), LTD., and ROSE, A. G.: Wrapping machines.
597,428. SALFISBERG, L. L.: Method of packaging and machine therefor.
597,543. ÉTABLISSEMENTS E. MATERNE, SOC. ANON.: Device for removing stalks from cherries.
597,604. POPPER, J.: Stoppers for bottles and similar containers.
597,642. ROBINSON, F., and JACOBSON, J.: Implements for paring and slicing beans.
597,708. AVERY, LTD., W. and T., and JONES, W.: Weighing, grading, and sorting apparatus.
597,710. PETSKEYES, C. H.: Bread slicing machine.
597,802. VANDOME AND HART, LTD., and FITZGERALD, F. C.: Weighing machines and scales.
597,860. SEAL-LESS STRAPPING, LTD., and MOSEY, F. W.: Strapping packages and the like.
597,880. NORTH AMERICAN HOLDING CORPORATION: Grading machine.
598,420. LEVER BROS. and UNILEVER, LTD.: Process for improving vegetable oils and fats.

Abstract of a Recent Specification

Improvements in the Manufacture of Bread and Yeast-Raised Baked Goods

This invention relates to the manufacture of bread and the like yeast-raised baked goods, its object being to provide a process which will enable all the ingredients of the dough-mix or batter to be thoroughly distributed throughout the mass; such a dispersion results in several advantages and usually simplifies the mixing operation.

The thorough distribution of the ingredients in this way gives many advantages in the manufacture of bread, particularly where the time employed from the making of the dough to the finished loaf is at a minimum, as in the case where what are known as "short time" doughs are employed.

The process comprises incorporating in the dough-mix an aqueous emulsion of an edible fat or oil stabilised by glycerine mono- or di-stearate and/or mono- or di-oleate. It is preferred to employ the above-mentioned stabilisers in an amount of from 6 to 10 per cent. calculated on the weight of the emulsion.

The aqueous emulsion also preferably contains known improvers such as soya flour, calcium or ammonium salts (*e.g.* acid calcium phosphate or ammonium chloride), bromates and/or persulphates of potassium and the like.

The edible oil or fat may consist of arachis oil, lard, or compound fat or mixture of these, or any type of fat suitable for use in baked goods.

588,958. *Samson Roos.*

Trade Marks

The list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal" and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

SWEET MEMORIES.—649,453. Chocolate and non-medicated confectionery. **J. Long, Ltd.**, 5, Bell Street, Whitchurch, Hampshire; Manufacturers.
SOL-VIT-AX.—650,093. Oils for use as food or as ingredients in food. **British Cod Liver Oils (Hull and Grimsby), Ltd.**, St. Andrew's Dock, Hull; Manufacturers.
PUROSTA.—653,518. Ground coffee. **Randolph Wallace Grant**, trading as **John Grant**, 9, Low Friar Street, Newcastle-on-Tyne; Merchant.
CHAD.—654,340. Sauces and vinegar. **Chad Pickle Company, Ltd.**, 134, Stoke Newington Church Street, London, N.16; Manufacturers and merchants.
CHEERIOS.—654,564. Cereal breakfast foods. **General Mills Inc.** (a Corporation organised under the laws of the State of Delaware, United States of America), 200, Chamber of Commerce Building, City of Minneapolis, 15, State of Minnesota, United States of America; Millers and Manufacturers.
OCEAN GOLD.—654,703. Edible oils and fats. **Vitamin Oils (Proprietary), Ltd.** (a Company incorporated under the laws of the Union of South Africa), East Quay, Docks, Cape Town, South Africa; Manufacturers.
VETINOL.—654,716. Edible oils and fats. **Vitamin Oils (Proprietary), Ltd.** (a Company incorporated under the laws of the Union of South Africa), East Quay, Docks, Cape Town, South Africa; Manufacturers.
BLUE BONNET.—655,325. Split lentils, split peas, dried peas, and dried beans. **White Brothers, Ltd.**, 8-14, Maguire Street, Vauxhall Road, Liverpool, 3; Millers.
CERATINA.—656,515. Semolina. **Seraflo, Ltd.**, Seraflo Works, Hythe Street, Dartford, Kent; Millers.

New Companies

Home and Export Packers, Limited. (440721.) London Yard, Manchester Road, Cubitt Town, E.14. To carry on bus. of packers, packing-case makers, etc. Nom. cap.: £1,000 in £1 shares. Dirs.: J. C. Badcock, The Knowle, Brenchley, Kent; F. W. Clarke, Oran House, Sandy Lane, Cheam; A. L. Biersey, W. H. Martin, and W. R. Pearcy.
Produce Driers, Limited. (440753.) 102, London Street, Reading. To carry on bus. of driers and processors of crops, corn, and grain factors, etc. Nom. cap.: £100 in £1 shares. Dirs.: A. W. A. Howell, 7B, Victoria Square, Reading; M. F. Stamford, 9, Oak Tree Road, Tilehurst.
R. Halley, Limited. (440755.) 25, High Street, Slough. To carry on bus. of manufacturers of and dealers in mineral and aerated waters, syrups, cider, perry, etc. Nom. cap.: £10,000 in £1 shares. Dirs.: F. A. Halley and Mrs. Gertrude E. S. Halley, both of Wraydene, Britwell Road, Burnham, Bucks.
Bryants Confectionery Company, Limited. (440783.) To take over bus. of manufacturing sugar confectioner carried on by R. G. Bryant at 104, Exmouth Street, Birkenhead. Nom. cap.: £1,000 in £1 shares. Dirs.: R. G. Bryant, 20, Kings Lane, Bebington, Ches.; N. L. Bryant, 21, Normanston Road, Birkenhead.
H. V. Wilson (Luton), Limited. (440839.) 3, Upper George Street, Luton. To take over bus. of a butcher and provision merchant carried on by H. V. Wilson at 43, Chingford Mount Road, E.14. Nom. cap.: £10,000 in 5,000 ord. and 5,000 6 per cent. cum. pref. shares of £1. Dirs.: H. V. Wilson and F. E. Hawkes, addresses not stated. Subs.: W. C. Ellis, 37, Deepdene, Potters Bar; S. E. Daniell, 16, Bowmead, S.E.9.
G. M. Salmon and Company, Limited. (440985.) Bancyfelin, Carmarthen. To carry on bus. of butter blenders and packers, etc. Nom. cap.: £5,000 in £1 shares. Dirs.: F. M. Salmon and Mrs. M. E. Salmon, both of Manordaf, Whitland.

Taken from the Daily Register, compiled by Jordan and Sons, Limited, Company Registration Agents, 116, Chancery Lane, London, W.C. 2.